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GEN. McAULIFFE TO JOIN AMERICAN CYANAMID CO.

General Anthony C. McAuliffe, Commander-in-Chief of the U. S. Army in Europe, who served as Chief Chemical Officer of the Army from October 1949 to June 1951, has applied for retirement from active service effective May 31, 1956.

Mr. K. C. Towe, President of American Cyanamid Company, with offices at 30 Rockefeller Plaza, New York 20, N.Y., recently announced that General McAuliffe is joining that company as General Manager of its newly created Engineering and Construction Division.

FORMER AFCA DIRECTOR HEADS MISSILE PROGRAM

Mr. Eger V. Murphree, of Summit, New Jersey, President of the Esso Research and Engineering Company, has been appointed to the newly created position of Special Assistant to the Secretary of Defense for Guided Missiles. Mr. Murphree is a member of A.F.C.A. and served for several years as one of the directors at large of the Association.

In his new capacity, Mr. Murphree will be responsible for the direction and coordination of all activities in the Department of Defense connected with the research, development, engineering and production of guided missiles, except those types already adopted for service use. He is expectd to devote major emphasis to missiles of the long-range type, particularly ballistic missiles.

During World War II, Mr. Murphree served as a member of the Office of Scientific Research and Development S-1 Committee, headed by Dr. J. B. Conant. This committee was instrumental in the establishment of the Manhattan Project which developed the atomic bomb.

A.F.C.A. HONOR TO MR. ROSENFELD

FOR MERITORIOUS SERVICE—For the second consecutive year, David A. Rosenfeld (center) of the Engineering Command, Army Chemical Center, receives an award for the part he played in recruiting new members for the Edgewood chapter, A.F.C.A. His citation was an engraved bar with chain, which was attached to the plaque he received last year. Colonel William J. Allen, Jr., commanding officer of the Engineering Command, is on the left and Gerald J. Fleming, president of the Edgewood chapter, is on the right.

THE HISTORICAL CORNER

By BROOKS E. KLEBER*
Prisoners of War at Edgewood

Manpower is a war-waging essential with which the United States has not always been overly blessed. In World War II the Chemical Warfare Service requirement for an increasing number of civilian personnel—in 1939 it employed 1,355 civilians, in 1942, 25,611—was met only with the greatest difficulty.

Prisoner of war labor was one method which helped to overcome this personnel shortage. German, Italian, and Japanese prisoners performer housekeeping duties, and those activities permitted by the Geneva Convention, at various CWS installations. In addition, prisoners of war did support work for CWS projects at non-chemical posts.

More than 1,900 PWs operated gas mask and gas mask carriers disassembly plants at Camp McCoy, Wis.; Pine Camp, N.Y.; Camp White, Ore.; Ft. Devens, Mass.; and Camp Grant, Ill. under the aegis of the appropriate chemical warfare procurement district. Another 1,900 prisoners performed Convention-permitted work at the four chemical warfare arsenals, Desert Chemical Warfare Depot, and Dugway Proving Ground. Of these, Edgewood Arsenal, with over 700 prisoners, had the largest contingent.

The Geneva Convention of 1929 specified the conditions of PW housing, food, clothing, medical care, and discipline as well as labor. The prisoners at Edgewood lived in theater of operation type barracks, although a small percentage were housed in winterized tents. For the most part, prisoners received the same rations as did American troops stationed in the zone of interior. Station hospital facilities were available to the PWs, and post doctors and dentists treated the prisoners daily at a dispensary within the stockade. Discipline was strict; punishment received by prisoners was as severe and swift as the Geneva Convention permitted.

The Convention prohibited the use of prisoner of war labor in any activity having a direct relation to war operations. Although this circumscribed their use, prisoners were nonetheless employed in mess halls, warehouses, motor pools, the commissary, and the station hospital, among other activities. Some PWs at Edgewood were farmed out, so to speak, and worked for various Harford County farmers. For this kind of activity the post dealt directly with the county agent, the representative of the War Foods Administration.

At first PWs were assigned to duties without much regard for their military or civilian backgrounds. After a period of relative inefficiency, the prisoners were interviewed and then given jobs on the basis of MOS numbers and civilian occupations. This system greatly increased the efficiency of prisoner of war labor.

*Member of the Staff, Historical Office, Office of the Chief Chemical Officer.

FRANK KROPIUNIK

A.F.C.A. Headquarters has learned with deep regret of the death of Mr. Frank Kropiunik, who was a Charter Member of the Association. Mr. Kropiunik, who resided at Rocks, Maryland, died on February 16, 1956.

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COVER PHOTO

The "magic box" carried by the soldier sounds a buzzer and shows a red light if nerve gas is present. See story on page 56.

The fact that an article appears in this magazine does not indicate approval of the views expressed in it by any one other than the author. It is our policy to print articles on subjects of interest in order to stimulate thought and promote discussion; this regardless of the fact that some or all of the opinions advanced may be at variance with those held by the Armed Forces Chemical Association, National Officers, and the Editors. It is the responsibility of contributors, including advertisers, to obtain security clearance, as appropriate, of matter submitted for publication.

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THE NEW PRESIDENT OF A. F. C. A.

Mr. Glenn A. Hutt, the new President of Armed Forces Chemical Association, elected by the Board of Directors at their 11th Annual Meeting in Boston June 14, is vice-president of the Ferro Corporation of Cleveland, Ohio, manufacturers of ceramic materials and equipment. For the past year Mr. Hutt has been a vice-president of A.F.C.A. and chairman of its Committee on War Mobilization Planning.

Mr. Hutt attended Ohio State University where he received the degree of Bachelor of Ceramics Engineering in 1930. Before joining Ferro in 1934, he was employed as a ceramic engineer with the Frigidaire Division of General Motors Corporation. In 1935 Ferro sent Mr. Hutt to Australia as director of the company's branch plant at Sydney. He was recalled to the United States in 1940 to become assistant sales manager. During the period 1942-1945 Mr. Hutt served in the Chemical Warfare Service of the Army from which he received his discharge in the grade of Captian. He was made assistant to the president of Ferro in 1949 and vice-president in 1951.

Mr. Hutt has been active in the Cleveland Community Chest and various other civic activities. He is president of the Porcelain Enamel Institute in Washington, D.C. He is a member of Al Koran Shrine, American Legion Post No. 54, and the American Ceramic Society.

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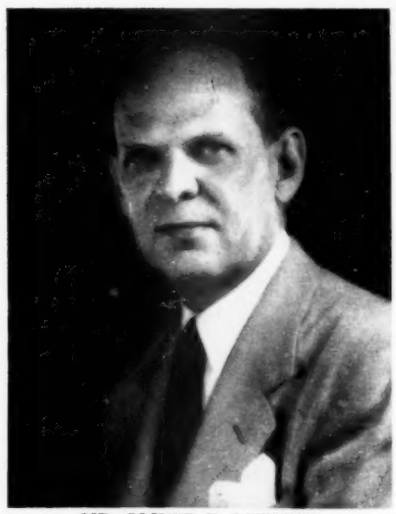

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DUGWAY EMPLOYS UTAH STUDENTS ON HALF-YEAR BASIS

A testing instrument in a Dugway Biological laboratory is explained by Dr. J. Clifton Spendlove, of the Biological staff (Seated), to Utah State Agricultural College students participating in on-the-job training at the Proving Ground.

DUGWAY PROVING GROUND, UTAH—Several students of Utah State Agricultural College at Logan are now participating in a student cooperative training program consisting of on-the-job training with pay in the Dugway Biological Warfare laboratories alternating with periods of scholastic work in college.

The program, which will offer the students journeyman scientific positions at Dugway upon their graduation, was initiated after a contract was made between Colonel Donald D. Bodé, post commander, and college officials.

Applications are accepted by the post from high school graduates or college students in Utah, who are completing courses in a curriculum leading to a bachelor's degree in one of the specialized fields needed by the Dugway laboratories.

The students selected for the program are divided into two groups. Each group will spend one-half of his college year in the Dugway laboratories and the other half in academic training at the college. While in Dugway, the students reside in modern dormitories.

During the training at Dugway, each student is paid a salary according to the Civil Service rating assigned him. Students enter the training program at a grade level consistent with the state of their academic progress and are promoted to progressively higher trainee grades. They receive no salary during their academic training period at the college.

Instruction of the trainees is the responsibility of Dr. Ian W. Tervet, Scientific Director of the Biological Warfare Assessment Directorate at Dugway and the division chief to which the trainees are assigned. The division chief appoints instructors, who have degrees from accredited colleges. Mr. William Fox, Chief of the Field Test division, is now in charge of the students.

Trainees are given daily on-the-job instructions with a minimum of twelve hours per month devoted to formal classroom training. A written examination is given the trainee twice each six months. In addition to evaluating their Dugway activities, the post also evaluates their academic progress.

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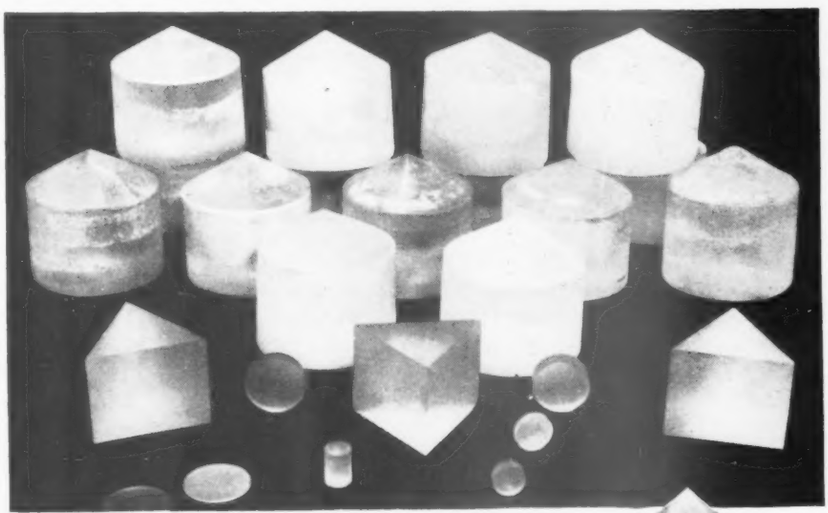

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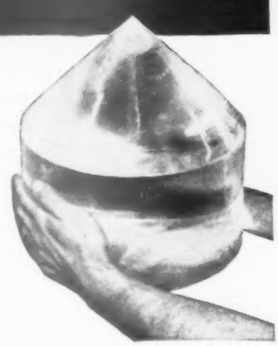

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Mr. Harry A. Wansker, General Chairman of the New England Committee in charge, turns over the gavel and rostrum to Brig. Gen. Clifford L. Sayre, USAR following his election by the Board of Directors at the meeting at the Somerset Hotel on June 14 as the Senior Vice-President for the ensuing year.

U.S. Army Pho

Maj. Gen. William M. Creasy, Chief Chemical Officer (center), pr sents Safety Awards to Brig. Gen. Marshall Stubbs, Commandi General, Army Chemical Center (right), and Col. William H. Green Commanding Officer Pine Bluff Arsenal, Arkansas.

11TH ANNUAL MEETING OF A. F. C. A.

THE 11TH ANNUAL MEETING of the Armed Forces Chemical Association, organized and engineered by the New England Chapter, was held in Boston, June 14 and 15. Despite severe, if not unprecedented, torrid weather, the meeting, attended by some 750 members and guests, was an outstanding success. Except for the banquet, air-conditioning of the assembly rooms used at the Somerset Hotel and the Kresge Auditorium at Massachusetts Institute of Technology, and the sea air enjoyed in a full day's cruise with the Navy on June 15, largely took care of the weather problem.

For variety and scope of its program, the meeting certainly will rank in the top group of the Association's Annual Meetings so far—possibly even the very top. It was notable on three scores: the series of philosophical and scientific presentations at the afternoon session on June 14 at the Kresge Auditorium; second, the unusual if not entirely unprecedented naval program for civilians of a day at sea aboard the *U.S.S. Antietam* and accompanying destroyers off Quonset Point, R I., on June 15, and, finally, evidence, as reflected in the banquet proceedings, of growing appreciation of the Association's positive efforts towards increasing the nation's scientific and technical manpower.

Meeting of Board of Directors

The two-day program which brought representatives from many of the Association's Chapters, commenced with a meeting of the Board of Directors in the Princess Room of the Somerset Hotel at 9 A.M. on June 14. A.F. C.A. President, Rear Admiral Nathaniel S. Prime, USN, Ret., still under medical care following a recent illness, was therefore unable to attend the meeting. In view of the absence also of Dr. Ralph E. Gibson, the First Vice-President, Mr. Harry A. Wansker, Vice-President for Meetings and General Chairman of the New England Committee on Arrangements for this gathering, took the chair at the opening of this session.

At this point it is pertinent to refer to Mr. Wansker's work for this meeting. Aided in many ways by a large and able committee he, nevertheless, was the mainspring in the six to eight months of arduous preparatory work to make the meeting the success it was. It is not practicable here to single out and name all of those who helped. It is in order, however, to note that much credit is due to Mr. Wansker's Company, the United-Carr Fastener Corporation, not only for the time given by Mr. Wansker, but for direct assistance by the Company in publication, secretarial and other services.

Following announcement by the Secretary of the new list of Directors-at-Large elected in the April balloting (pictures in this issue), the Board received a report from the Nominating Committee represented by Major General William A. Porter, USA, Ret., who presented a slate for the Association's officers for the forthcoming year. This list of nominees, all of whom were unanimously elected, is as follows:

Ladies of the A.F.C.A. boarding bus for all-day visit to the U. S. Naval Air Base at Quonset Point, R.I., on June 15.

Col. William H. Greene, Commanding Officer of Pine Bluff Arsenal, receiving A.F.C.A.'s bronze plaque Safety Award to the Arsenal for its outstanding safety record, from Gen. Sayre.

Brig. Gen. Sayre at the morning session on June 14 introduces the principal speaker at that session, Dr. Per K. Frolich, Deputy Chief Chemical Officer for Scientific Activities.

GENERAL REPORT

President: Mr. Glenn A. Hutt, Cleveland Chapter; Vice-President Ferro Corporation, 4150 East 56th St., Cleveland 5, Ohio.

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Vice-President—Research and Development: Dr. Ralph E. Gibson, Washington, D.C. Chapter; Director, Applied Physics Laboratory, Silver Spring, Md.

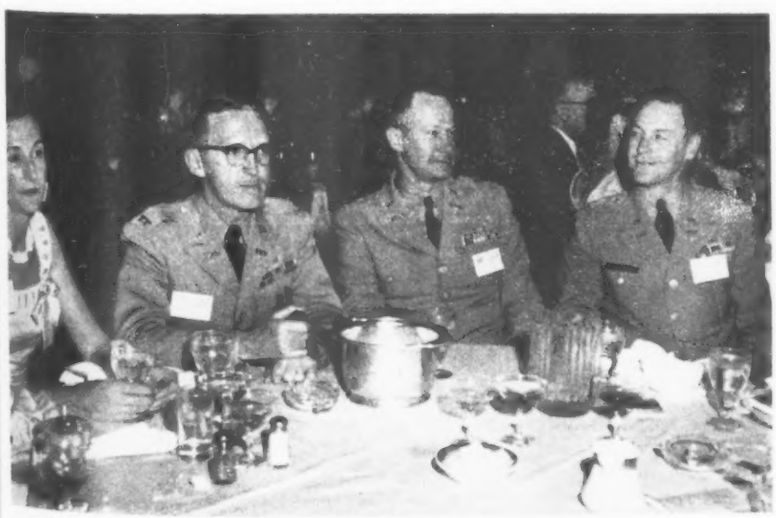
Vice-President—War Mobilization Planning: Mr. Walter E. Spicer, Jr., New York Chapter; Lambert-Hudnut Division, Warner-Lambert Pharmaceutical Co., 930 Newark Ave., Jersey City 6, N.J.

After the election, Mr. Wansker turned over the gavel and rostrum to General Sayre, the new Senior Vice-President, who then took charge and presided during the remainder of the session.

The Directors took note of the provisions already made

(Continued on page 10)

A Chemical Corps Group at the Annual Banquet at the Hotel Somerset June 15. Left to right: Mrs. Hayes, Colonel Hayes, Commanding Officer, Biological Warfare Laboratories, Fort Detrick, Md.; Major Douthit L. Furches, instructor at M.I.T., and Brig. Gen. Jacquard H. Rothschild, Commanding General, Chemical Corps Research & Development Command, Washington, D.C.



Dr. Clifford C. Furnas, Asst. Secretary of Defense, speaking at the Banquet at Hotel Somerset, June 15.

A. F. C. A.'s DAY WITH THE NAVY

OFFICIAL U. S. NAVY PHOTOS

USS ANTIETAM sailors in welcoming gesture prior to the meeting form the initials of the Association on deck.

Dock at Quonset Point, R.I., U.S. Naval Air Station, showing destroyers ready to take aboard A.F.C.A. visitors.

Part of the A.F.C.A. group accompanied their sons aboard the destroyers for the day's cruise with the ANTIETAM.

THE ENTIRE DAY of June 15 during A.F.C.A.'s 11th annual meeting was taken up with programs provided by the U. S. Navy.

More than 500 members and guests, including about fifty teen-age boys, mostly sons of members, embussed at 5:45 A.M. at the Hotel Somerset, Bosotn, and proceeded to the U. S. Naval Air Station at Quonset Point, R.I. Of this group, about 350 went aboard the *U.S.S. Antietam,* the giant aircraft carrier which participated extensively in the Korean operations, the first angled deck carrier in naval history. The remainder, about 175, including most of the boys, were distributed among the four destroyers which participated with the *Antietam* in the ensuing all-day program at sea demonstrating means of combating enemy submarines.

One of the Essex class of aircraft carriers, the *Antietam* is no doubt of modest proportions compared with such later models as the *U.S.S. Forrestal.* However, the *Antietam* is still of impressive size. It was pointed out that if its flight deck, nearly 900 feet long, were part of a golf course it would be a "par-4 hole." The enclosed hangar deck, with its several enormous elevators for quick movement of aircraft and equipment to the flight deck immediately above, reminds one of the floor of a giant warehouse.

The *Antietam* contingent of the visitors was assembled and divided into two groups and these then subdivided into parties of 20, each in charge of a junior naval officer.

First, there was a tour of the hangar deck with special exhibits of various sorts of naval gear. The organization of the ship which has a complement of some 2,000 officers and men, it was stated, is so extensive and complex that virtually no one person aboard is fully familiar with the entire establishment. This could readily be appreciated by the visitors. On the one hand there are the usual strictly nautical and naval provisions of

A.F.C.A. ladies have lunch at the enlisted men's mess during their visit to the U.S. Naval Air Station.

U.S. Naval Aviation Cadet Choir from academy at Pensacola, Fla. sung for the A.F.C.A. ladies at Quonset Point and later at banquet.

The Navy's famous "Blue Angels" in flight.

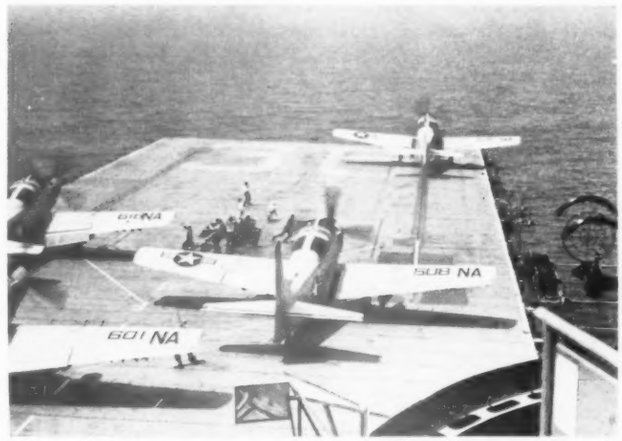
Guests of Admiral James R. Lee, Commander Carrier Division No. 14, aboard the USS ANTIETAM. Left to Right: Admiral Lee, Mr. Chenery Salmon, Mr. Harry A. Wansker, The Honorable Clifford C. Furnas, Assistant Secretary of Defense.

a great war vessel, from anti-aircraft guns to whaleboats; while on the other hand, the ship, being a floating air field, contains various types of combat aircraft and the specialized service organizations and equipment, required for air operations, including yellow painted towing trucks.

Indeed, to the visitor unfamiliar with carriers, the air operations personnel present a somewhat bizarre picture, garbed as they are in gaily-hued attire not usually associated in the layman's mind with the sea. Each different class of air-service personnel, depending upon its class of duties, such as ammunition handling, gas and oil, etc., wears bright colored jerseys and helmets. Thus one group is in vivid green, one in scarlet red, one in bright blue, one in brown, etc. But standing out, easily distinguishable among all these airmen is one individual man, the LSO, (Landing Signal Officer). He wears coveralls marked with stripes of brilliant, luminescent fabric so that he can be distinguished unmistakably by pilots awaiting his paddle signals to land.

Completing the hangar deck tour, visitors are assembled on one of the enormous elevators, the portside one midway of the ship. It has no sides or protection rail, and one has the impression that if he ventures too near the outer edge he may find himself in the sea. However, he perceives later that there is a network arrangement extending around the outer edges of the elevator platform which no doubt would save him if he stepped off the side. In fact he later makes the comforting discovery that there is a gangway with substantial railing extending all around the flight deck just below the surface. This makes for safety, of course, and also facilitates movement without interfering with flying operations.

(Continued on page 10)

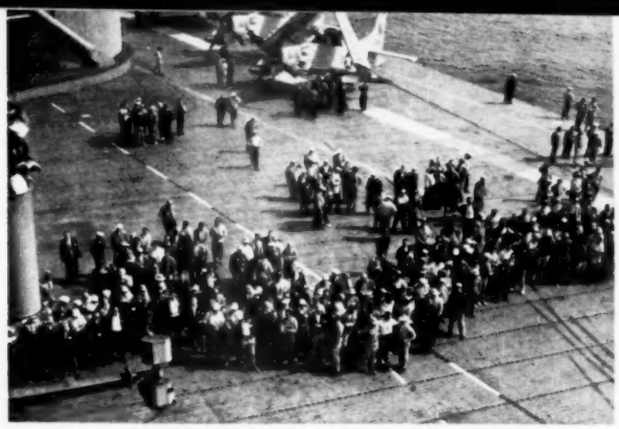


Aircraft being catapulted from deck—USS ANTIETAM.

Aircraft being readied for takeoff during A.F.C.A. Show—In foreground, platform of one of the giant elevators.

A.F.C.A. ladies look on in amazement as Blue Angels demonstrate precision flying maneuvers off Quonset Point, R.I.

Capt. Francis E. Bardwell, Commander of the USS ANTIETAM, receiving a picture of the Bardwell coat-of-arms from New England Chapter, presented by Mr. Wansker.



Aboard the USS ANTIETAM—part of A.F.C.A. group observing demonstration on flight deck.

With the blowing of the raucous, unmistakable "bull horn" which warns of all elevator movements, visitors are whisked in a jiffy to the flight deck. The first event is a demonstration of the use of large single-rotor helicopters in enemy submarine location operations. After this, these weird craft which look like giant dragon-flies retire to their base at Quonset. But one smaller helicopter, a two-rotor one, remains with the ship and flies protectively about throughout the day. This aircraft, it is explained, is appropriately known on all carriers as "The Angel." It is there for rescue purposes in case an airplane is "ditched" or someone falls overboard.

After a hasty luncheon in the wardroom visitors returned to the flight deck to observe take-offs and landings by various types of aircraft and a demonstration also of the catapult launching method. Landing of airplanes using grappling hooks to engage a cable stretched across the flightdeck so as to bring the incoming plane to a quick stop was demonstrated and explained. Impressive also was the "touch and go" landing practice of jet aircraft from Quonset. In these training operations, described as both economical and time-saving, the pilot, upon receiving the OK for landing signal from the LSO, causes his plane merely to touch the flight deck and then zoom off again into the air.

After these events visitors gathered at the portside to witness rocket firing and dive bombing from aircraft using live ammunition in demonstrating methods of attack upon hostile submarines. The firing appeared to be executed with remarkable accuracy. Later in the afternoon during this phase a submarine appeared from the New London, Conn., base and demonstrated submerging and broaching operations.

Smoke screening and high-speed maneuvers by the accompanying destroyers and also simulated use of depth charges followed as, late in the afternoon, the *Antietam* turned to steam back up Narragansett Bay to dock at Quonset Point.

While the ship was being docked, visitors could see in the distance on one of the Quonset runways five sleek blue aircraft lined up abreast ready for takeoff. Then, moving as one, all five took off—the Navy's famous precision flying team, "The Blue Angels." For the next fifteen minutes the guests aboard and the A.F.C.A. ladies ashore, were treated to a breath-taking showing of high-speed flying formations. Blue and red smoke trailing from the airplanes in some of the flying figures contributed to the spectacular effect and provided a very appropriate touch for this occasion since colored smoke for military purposes is a development and supply item of the Army Chemical Corps.

The Blue Angels' show over, the visitors disembarked to return to Boston after a most worthwhile and interesting program which, all would agree, reflected high credit on the U.S. Navy.

ANNUAL MEETING

(Continued from page 7)

for holding the 1957 Annual Meeting in Washington, D.C., where the U.S. Air Force will again, as in 1954, accept the role of "host service." No decision was reached, however, with respect to time and place for the 1958 meeting, since it appeared from the discussion that no firm proposals for that meeting, carrying full approval of a candidate chapter, had been received. Accordingly, the matter of advance arrangements for the 1958 gathering pursuant to "two-years-in-advance" planning policy, was referred for appropriate action by the Executive Committee.

Announcement was made of amendments to Articles II and III of the By-Laws, which had been adopted by the Board of Directors in a recent vote by mail. These changes were as follows:

(1) Change in Section 2 of Article II increasing dues of regular members from $5.00 to $7.50 per annum, and increasing group member dues from $100.00 to $150.00 per annum. (Dues for student, life and sustaining members are not changed.)

(2) Change in Section 3 of Article II to increase the chapter credit payment for each regular and each group member in the chapter from $1.00 to $1.50.

(3) Change in Section 3, of Article III, eliminating numerical designations of vice-presidents and substituting new designations as follows:

The Senior Vice-President, who shall preside in the absence of the President.

Vice-President, Chairman of the Finance Committee.

Vice-President, Chairman of the Committee on Membership and Organization.

Vice-President, Chairman of the Committee on Publications.

Vice-President, Chairman of the Committee on Meetings.

Vice-President, Chairman of the Committee on Research and Development.

Vice-President, Chairman of the Committee on War Mobilization Planning.

Upon completion of these actions and following the receipt and approval of the Secretary-Treasurer's annual report the Directors adjourned. The meeting was followed by the 11th Annual General Meeting of the Association in the same Auditorium commencing at 11 A.M.

Message from President Eisenhower

Especially noteworthy among the number of messages of greeting and congratulations received on the occasion of this meeting, was a telegram from President

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Eisenhower, published in facsimile in a souvenir program, dated "The White House, Washington, D.C., May 16," and addressed to Rear Admiral Prime, the then President of A.F.C.A. The message was as follows:

To Rear Admiral N. S. Prime, USN (Ret.), President Armed Forces Chemical Assn., Washington, D.C.

PLEASE EXTEND MY GREETINGS TO THE MEMBERS AND GUESTS OF THE ARMED FORCES CHEMICAL ASSOCIATION ON THE OCCASION OF YOUR ELEVENTH ANNUAL MEETING.

THE KNOWLEDGE AND EXPERIENCE OF YOUR MEMBERSHIP EXEMPLIFY THE SKILLS AND TRAINING ESSENTIAL TO THE NATIONAL DEFENSE IN AN ERA OF ADVANCING SCIENCE AND TECHNOLOGY. AS A TIME OF AN INCREASING DEMAND FOR CHEMICAL SCIENTISTS, IT IS GRATIFYING TO KNOW THAT THE ASSOCIATION IS INCLUDING YOUNG PEOPLE IN ITS PLANNING. I CONGRATULATE ALL OF YOU ON YOUR WORK FOR THE WELFARE OF THE REPUBLIC AND WISH YOU A SUCCESSFUL MEETING.

Signed: DWIGHT D. EISENHOWER.

Letters of greeting were also received from Admiral Arleigh Burke, Chief of Naval Operations; Maj. Gen. William M. Creasy, U.S.A., Chief Chemical Officer; Rear Admiral J. A. Snackenberg, U.S.N., Commandant First Naval District and A.F.C.A. President Prime.

Mr. Glenn Hutt, the newly elected President of the Association, was not present at the Boston meeting, having been prevented from attending by an important previous engagement. In view of his absence, the customary short meeting of the new Executive Committee was deferred.

The general session of the Association opened at 11:00 A.M., with General Sayre presiding. In accordance with the established practice, the first order of business at this session was the announcement and presentation of various awards. The Association's bronze plaque awarded annually to a Chemical Corps installation having an outstanding record of safety from accident of all sorts went this year to Pine Bluff Arsenal, Arkansas. General Sayre presented the plaque to Colonel William H. Greene, Commanding Officer of the Arsenal. Colonel Greene also received for the Arsenal at this meeting the National Safety Council's highest award, "The Award of Honor," represented also by a bronze plaque. The Chemical Corps was one of six Army agencies, and the only one of the various Technical Services of the Army, to receive this honor this year. The presentation of the plaque was made at this meeting by Maj. Gen. William M. Creasy, Chief Chemical Officer of the Army, who is also Honorary President of A.F.C.A. Another safety honor, the highest given by the Department of the Army in recognition of outstanding success in reducing the rate of accidents of all types at an Army installation, was awarded this year to the Army Chemical Center, Md., and was received for the Center by Brig. Gen. Marshall Stubbs, Commander of the Center. This plaque was also presented by General Creasy.

The members directed that the Association's distinguished service award, a bronze plaque, be made to outgoing president, Admiral Prime, in recognition of his greatly appreciated services as president during the past two years, and requested General Creasy to see that it was duly delivered to Admiral Prime. The members also directed the presentation of a suitably inscribed scroll to Dr. Walter E. Lawson, a past president of A.F.C.A., in recognition of his extensive work for the Association even after his term as president. Dr. Lawson, now retired, is residing at his country home at Moon, Virginia.

Results of the election of new officers at the previous meeting of the Board of Directors were announced.

A special feature of this General Meeting was the address by Dr. Per K. Frolich, Deputy Chief Chemical Officer for Scientific Activities, Department of the Army. His informative and interesting presentation, entitled "The Chemical Corps: Better Management for Defense," is printed in full in this issue.

Following adjournment for the luncheon period, the members and guests proceeded by special buses to the Massachusetts Institute of Technology in nearby Cambridge for an afternoon of scientific addresses in the Kresge Auditorium. This auditorium is a remarkable building of modernistic design incorporating special lighting and acoustic features. The afternoon program brought forth a number of outstanding addresses, some among them dealing with technological and philosophical aspects of the atomic era. The speeches, including the address of welcome by Dr. James R. Killian, Jr., president of M.I.T., are reported upon or presented in full in this issue. The attendance at the M.I.T. meeting was estimated as more than 500. The audience included a fair number of students, perhaps a hundred or two. Mr. Albert E. Forster, president of the Hercules Powder Company, presided. While not on the program for a speech, General Creasy, the Chief Chemical Officer of the Army, was present and was honored by appropriate ruffles and march played by an Army band furnished for the occasion from Fort Devens, Mass. In addition to General Creasy, many of the top military and civilian staff of the Chemical Corps were present at the Boston meeting including the M.I.T. session. M.I.T. is indeed of special interest to the Chemical Corps. Since World War I many of its officers have studied and received advanced degrees there and it is at the Institute that the first Chemical Corps R.O.T.C. unit was organized.

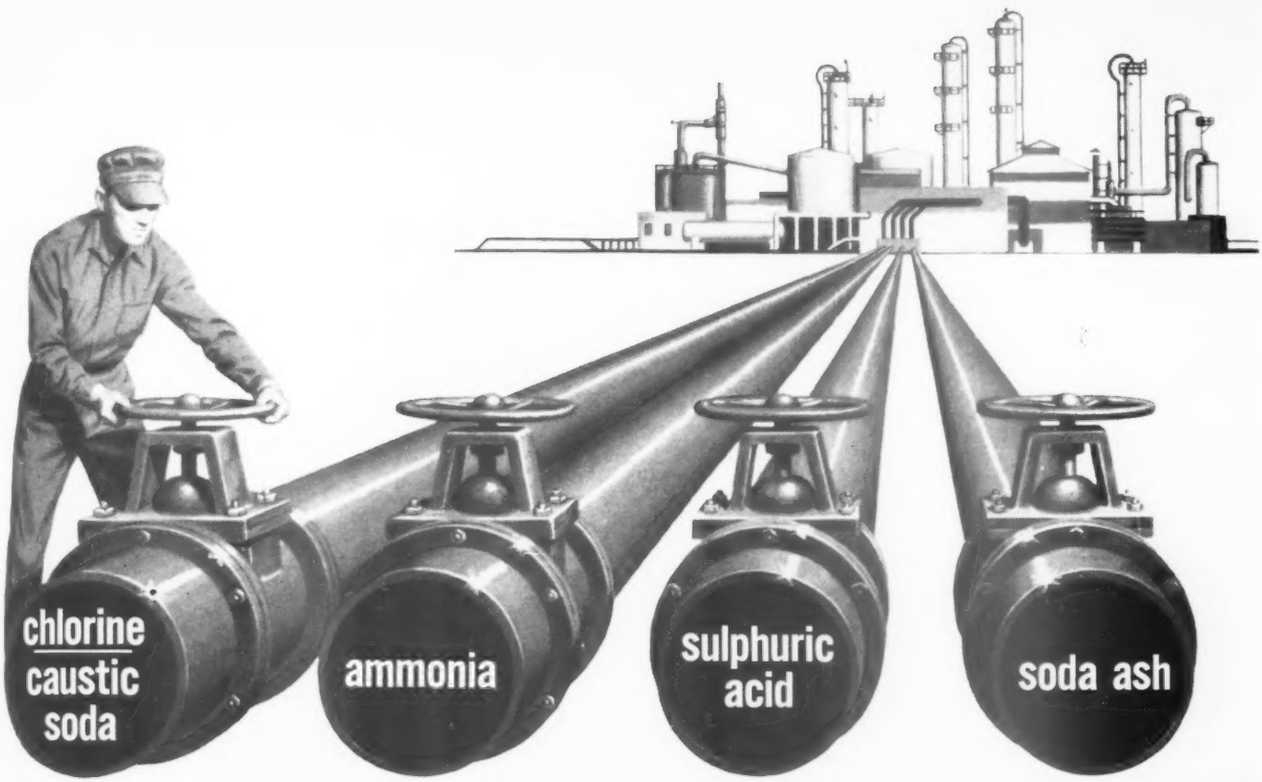
The Boston gathering provided possibly the most elaborate special program for ladies of any of the Annual Meetings thus far. On June 14 there was an all-day tour of places of historic interest in the vicinity of Boston. This included "The House of Seven Gables" at Salem, made famous by Nathaniel Hawthorne in his novel of that title; a stop for luncheon at Corinthian Yacht Club at Marblehead; and a visit to Babson Institute of Business Administration, at Wellesley, where tea was served, with Mrs. Edward B. Hinckley, wife of the President of the Institute, as hostess.

On June 15, the women's group, which included daughters of a number of the members, left the Hotel at 9:30 A.M., and proceeded to the Naval Air Station at Quonset Point, R.I. There was a full day's program, including visits to the various installations at the base and luncheon. The ladies were escorted by Waves detailed as guides from the Wave detachment at the base. Many of the A.F.C.A. group remarked upon the smart appearance and courteous manners of these young women members of the Navy.

The Annual Banquet

The Annual Banquet was held in the Louis XIV ballroom at the Hotel Somerset. Places were laid for 750 guests.

Mr. Wansker, General Chairman, presided at the Banquet. Each guest received a copy of the elaborate illustrated souvenir program, prepared by the General Committee, which included the seating list for the Banquet.



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At the Speaker's Table were:

CAPTAIN ROBERT E. RIERA, U.S.N., Representing Vice Admiral Austin K. Doyle, Commanding Officer, Naval Air Training Station, Pensacola, Florida.

DR. EDWARD B. HINCKLEY, President, Babson Institute of Business Administration.

CAPTAIN FRANK M. SLATER, U.S.N., Representing Rear Admiral J. M. Hoskins, Commander Fleet Air, Quonset Point, R.I.

CAPTAIN CHARLES B. MARTELL, U.S.N., Commanding Officer, *U.S.S. Boston*.

DR. PER K. FROLICH, Deputy Chief Chemical Officer for Scientific Activities, Department of the Army.

REAR ADMIRAL R. L. RANEY, U.S.C.G., Commander, First Coast Guard District.

MONSIGNOR O'LEARY.

ALBERT E. FORSTER, President, Hercules Powder Company.

REAR ADMIRAL JOHN A. SNACKENBERG, U.S.N., Commandant, First Naval District. Represents (1) Hon. Charles Thomas, Secretary of the Navy; (2) Admiral Arleigh A. Burke, U.S.N., Chief of Naval Operations.

O. V. TRACY, Director, Esso Standard Oil Co. and President Enjay Co.

HARRY A. WANSKER, Director of Government Relations, United Carr Fastner Corporation.

HONORABLE CLIFFORD C. FURNAS, Assistant Secretary, Department of Defense (R & D).

ADMIRAL JERAULD WRIGHT, U.S.N., Commander-in-Chief, The Atlantic Command and the United States Fleet.

CAPTAIN FREWEN, Royal Navy, guest of Admiral Wright.

MAJOR GENERAL RAYMOND C. MAUDE, U.S.A.F., Commander Air Force Cambridge Research Center.

EARL P. STEVENSON, Chairman of the Board, Arthur D. Little, Inc.

MAJOR GENERAL WILLIAM M. CREAS[illegible], U.S.A., Chief Chemical Officer, Department of the Army.

HOWARD B. OWENS, Biology Teacher, Northwestern High School, Hyattsville, Md.

BRIGADIER GENERAL J. P. BERKELEY, U.S.M.C., Assistant Chief of Staff, G-1, Headquarters, U. S. Marine Corps.

COLONEL ROLAND P. ANDERSON, U.S.A., Commanding Officer, Boston Ordnance District.

RAYMOND STEVENS, President, Arthur D. Little, Inc.

CAPTAIN HARRY C. MAYNARD, U.S.N., Commanding Officer, The Underwater Testing Station, Newport, R.I.

The assembly for the Banquet included some 250 secondary school students from public, high, parochial and preparatory schools in the Boston area. These students, selected for their special aptitude for science subjects, had been the guests during the day of the Esso Standard Oil Company at its refinery in Everett, Mass. and were guests of the Company at the banquet also. This feature of the meeting, as one of the moves by the New England chapter toward stimulating student interest in science and mathematics, was described briefly by Mr. Osgood V. Tracy, a Director of the Company, who was one of the guests at the Speakers' Table. The attendance of the students was also commented upon especially by the principal banquet speaker, Dr. Clifford C. Furnas, Assistant Secretary of Defense, as an example of constructive work of the Association in seeking to extend interest in science and engineering careers among high school students. (Dr. Furnas' address is printed in this issue).

The banquet program included Invocation by Dr. Edward B. Hinckley, an ordained minister, who is President of the Babson Institute; playing of the National Anthem; presentation of the colors by a Color Guard representing all of the Armed Services. Music was furnished by a Navy Band from the First Naval District and also by the nationally famous Naval Aviation Cadet Choir, consisting of 60 members of the Naval Air Training Command, Pensacola, Florida. This remarkable group of singers, under the direction of Ensign Fred Shadd, also sung in the program for the A.F.C.A. ladies during their day at Quonset Point Air Station.

After introducing the distinguished guests, Mr. Wansker presented the Association's $1,000 Award for outstanding service as a science teacher to Mr. Howard B. Owens, Biology Teacher at Northwestern High School, Hyattsville, Maryland. Mr. Owens, accompanied by his wife, were special guests of the Association for this meeting. A separate report concerning this award is contained in this issue.

Another special feature of the banquet program was the announcement by Mr. Wansker of a donation of $1,000 by the New England Chapter of A.F.C.A. to the Navy Relief Society. Rear Admiral John A. Snackenberg, U.S.N. Commandant, First Naval District, responded to Mr. Wansker's announcement and received the check on behalf of the Society expressing deep appreciation of the Society and the Navy. This feature came as a complete surprise to Admiral Snackenberg and his colleagues attending. The plan to make such a donation from proceeds of the meeting had previously been coordinated with the Executive Committee of A.F.C.A.

Referring to the impressive program of events provided for the Association during the day aboard the *U.S.S. Antietam* and at the Quonset Point, R.I., Naval Air Station, Dr. Furnas suggested a vote of thanks and appreciation to the Navy; he made special mention of the magnificent performance of The Blue Angels. In response the entire assembly stood up.

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CHEMICAL CORPS HAS ELECTRONIC "BRAIN"

Among recent "Army News Feature" releases is a story about the Chemical Corps' new "electronic brain" at the Army Chemical Center, Md., pictured herewith with Specialist Marion A. Sanders and Mr. Joseph S. Tyler engaged in checking some of the gadgets' wiring.

It is stated that, while experts at the Center have not thrown away their slide rules, the new "brain" nevertheless provides an easier way to get fast replies to tough questions. This computer does more work in a year than the mathematicians who feed problems into it could figure in their heads in a lifetime.

The "brain" is reported to be especially useful to evaluate the effectiveness of types of munitions. An example cited is comparison of the concealment potential of many small widely-scattered smoke bombs versus a few big smoke pots in a given area under certain wind and temperature conditions. There's a catch, however, about this machine: *answers* must be fed into it as well as questions .The machine picks the correct one.

The "brain" is tireless if kept cool —so a large air-conditioning unit is provided for it. In charge of the computing machine is Mr. Edgar S. Williams, mathematician at the Center.

A. F. C. A. $1,000 AWARD TO SCIENCE TEACHER

MR. HOWARD B. OWENS

Association's action reflects opinion that the nation's technical manpower potential depends essentially on students' interest in science inspired by outstanding teachers at the high school level.—Ed.

THE SCIENCE TEACHER AWARD, for which the Directors of the Armed Forces Chemical Association appropriated $1,000.00, has been given to Mr. Howard B. Owens of Hyattsville, Maryland, as the most outstanding science teacher of those nominated.

The decision of the Science Teacher Award Committee was unanimous in the placing of the first three candidates. In its report to the Executive Committee it stated that it considered each candidate nominated to be an outstanding teacher in the true sense of the term.

Mr. Owens, a biology teacher at Northwestern High School, Hyattsville, Maryland, received the nomination of the Baltimore Chapter of the Armed Forces Chemical Association and was described as an outstanding example of a dedicated and inspiring teacher most worthy of consideration.

Mr. Owens is a graduate from Washington College, Chestertown, Maryland, with a degree of Bachelor of Science in Economics.

In his professional career, Mr. Owens has demonstrated great courage and determination in overcoming a physical handicap resulting from an attack of polio in early youth. His success as a teacher of science in private schools persuaded the authorities in Maryland to extend his achievements to public school teaching and his outstanding performance in this field has been recognized by the University of Maryland in the form of invitations to conduct courses on methods of science teaching in secondary schools.

Mr. Owens received a Master of Science degree from the University of Maryland in December 1944. He has almost completed work for a Ph.D. degree. His major field is entomology with minors in zoology and education.

The terms and rules for the contest were outlined in the January-February 1956 issue of the JOURNAL. The selection was made on the supported statements of the nominating Chapter in its letter of nomination.

Mr. Owens has received some unusual recognition in the course of his career. The Washington Academy of Science made him the recipient, on March 20, 1952, of an award for scientific achievement in recognition of his distinguished service in teaching science.

The Boy Scouts of America recognized his distinguished service to boyhood when it honored him with the Silver Beaver Award. In its citation, he was credited, among other achievements, with his teaching of science.

During the fall convocation of 1954, Washington College at Chestertown, Maryland, presented Mr. Owens with an alumni citation for outstanding achievement in the field of education.

The Department of Education of the State of Maryland had Mr. Owens on its TV program over Station WMAR-TV in a program entitled "Comeback." The program featured his achievements in teaching after having been rehabilitated from polio.

In school science fairs and other forms of competitive efforts, Mr. Owens' pupils have won recognition for themselves and their teacher. These students have testified that their choice of a scientific career stemmed from their contacts with Mr. Owens in the biology classroom.

The records of Mr. Owens' students which include scholarships won at such colleges as M. I. T., Cornell, University of Pennsylvania, Washington College, Duke University, University of Maryland, Tufts College, University of Rochester, Harvard, Oberlin, etc., are a remarkable tribute to his teaching ability. Their election to follow science courses in the college of their choice is strongly indicative of the effects of their training under Mr. Owens.

Letters from college professors are compelling evidence of the superior qualities of Mr. Owens' teaching and attest to the fact that his students receive training of a high order.

Mr. Owens' personal interest in science is evidenced by his association with scientific groups and memberships therein. He is active in numerous scientific groups, viz.:

Member of the Washington Academy of Sciences;

Member of the Governing Board of the Washington Junior Academy of Sciences;

Vice President of the Biological Society of Washington;

Member of the Entomological Society of Washington;

Alternate Director of National Science Teachers Association, etc.;

Member of National Association of Biology Teachers;

A. F. C. A. Membership Key

May we present our new mark of membership in the Armed Forces Chemical Association—a beautiful key!

There is no regulation governing the manner in which the key may be displayed. That is a matter to be determined by each individual. We show it here suspended from a tie-clasp chain. It seems likely that this may prove the most popular manner of displaying the key.

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Engraving of up to five initials on back of key may be included without charge.

*Tie clasp as shown without key:

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Where state sales tax is applicable, it must be added to above figures.

Remittance of $_____ is enclosed herewith.

Initials desired _____
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Address _____

Member of Maryland Biology Teachers Association;
Member of Maryland Science Teachers Association;
Member of American Nature Study Society;
Member of Entomological Society of America;
Member of American Association for the Advancement of Science;
Member of Executive Committee of the Prince George's Science Fair Association and others.

In many ways, Mr. Owens has shown his interest in science and his loyalty to his teaching. Over all of this has been his persistence in his search for knowledge by the continuation of his studies. His publications that reached the printing stage are also evidence of his activity in the scientific field.

Mr. Owens' traits as one who follows the science trail were rather well depicted by the Baltimore Chapter's Nominating Committee. His injection into his classroom of his personally-taken motion pictures and photographs, his originality in presenting his subject to his pupils, his operation of science fairs, his science teachers association activities attest his fitness for the Award.

The Committee, in its evaluation of the data submitted by the nominating chapters, was fully cognizant of the fact that there is much in the relationship of teacher and scholar that is impossible to evaluate or to rate by comparison. It does believe that Mr. Owens stands first in a contest which disclosed some excellent and outstanding teachers of science in the secondary school system.

It is hoped that by the recognition, in this instance, of qualities most desired in a science teacher it may in some way encourage others to make similar efforts and bring to us all a keener appreciation of the need for good teachers.

For the Committee,
O. E. Roberts, Jr.
Secretary

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Diamond Alkali Company, Cleveland, Ohio
Dow Chemical Company, Midland, Mich.
E. I. duPont de Nemours & Co., Inc., Wilmington, Del.
Edo Corporation, College Point, N.Y.
Eldon Manufacturing Company, Los Angeles, Calif.
Empire Stove Company, Belleville, Ill.
Esso Research and Engineering Co., New York, N.Y.
Evans Research & Development Corp., New York, N.Y.
Federal Laboratories, Inc., Saltsburg, Pa.
Ferguson, H. K., Company, The, Cleveland, Ohio
Ferro Corporation, Cleveland, Ohio
Firestone Industrial Products Co., Fall River, Mass.
Fisher Price Toys, Inc., East Aurora, N.Y.
Fisher Scientific Co., New York, N.Y.
Food Machinery & Chemical Corporation, New York, N.Y.
Foster Wheeler Corporation, New York, N.Y.
Fraser & Johnston Co., San Francisco, Calif.
General Aniline & Film Corporation, New York, N.Y.
General Tire & Rubber Company, The, Wabash, Ind.
Goodrich, B. F., Chemical Company, Cleveland, Ohio
Goodyear Tire & Rubber Company, Akron, Ohio
Grace Chemical Company, New York, N.Y.
Gray Stamping & Manufacturing Co., Plano, Ill.
Gulf Oil Corporation, Pittsburgh, Pa.
Handy & Harman, New York, N.Y.
Harshaw Chemical Company, The, Cleveland, Ohio
Harvey Machine Co., Inc., Torrance, Calif.
Hercules Powder Company, Wilmington, Del.
Hesse-Eastern Corporation, Cambridge, Mass.
Heyden Chemical Corporation, New York, N.Y.
Hooker Eletrochemical Company, Niagara Falls, N.Y.
Industrial Rubber Goods Company, St. Joseph, Mich.
International Nickel Co., Inc., New York, N.Y.
International Salt Co., Inc., Scranton, Pa.
International Silver Company, The, Meriden, Conn.
Jefferson Chemical Company, Inc., Houston 1, Texas
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Kennecott Copper Corporation, New York, N.Y.
Kilgore, Inc., Westerville, Ohio
Koppers & Company, Inc., Pittsburgh, Pa.
Kwikset Locks, Inc., Anaheim, Calif.
Lambert-Hudnut Division, Warner-Lambert Pharmaceutical Company, St. Louis, Mo.
Eli Lilly and Co., Indianapolis 6, Ind.
Little, Arthur D., Inc., Cambridge, Mass.
Mason, L. E., Company, Hyde Park, Mass.
Merck & Company, Inc., Rahway, N.J.
Miles Laboratories, Inc., Elkhart, Ind.
Milwaukee Stamping Co., Milwaukee, Wis.
Mine Safety Appliances Co., Pittsburgh, Pa.
Monarch Aluminum Mfg. Co., Cleveland, Ohio
Monsanto Chemical Company, St. Louis, Mo.
National Fireworks Ordnance Corp., West Hanover, Mass.
Niagara Blower Co., New York, N.Y.
Oldbury Electro-Chemical Co., Niagara Falls, N.Y.
Olin Mathieson Chemical Corp., East Alton, Ill.
Oronite Chemical Company, San Francisco, Calif.
Parsons, Ralph M., Company, The, Los Angeles, Calif.
Pemco Corporation, Baltimore, Md.
Penick, S. B., & Company, New York, N.Y.
Pennsylvania Salt Manufacturing Co., Philadelphia, Pa.
Pfizer, Chas. & Company, Inc., Brooklyn, N.Y.
Philco Corporation, Philadelphia, Pa.
Phillips Petroleum Company, Bartlesville, Okla.
Pittsburgh Coke & Chemical Co., Pittsburgh, Pa.
Rohm & Haas Company, Philadelphia, Pa.
Scovill Manufacturing Company, Waterbury, Conn.
Shea Chemical Corp., Jeffersonville, Ind.
Shell Chemical Corp., Denver, Colo.
Shell Development Company, Emeryville, Calif.
Sheller Mfg. Co., Dryden Rubber Div., Chicago, Ill.
Sherwin-Williams Company, The, Cleveland, Ohio
Shwayder Bros., Inc., Denver, Colo.
Standard Oil Company (Indiana), Chicago, Ill.
Stauffer Chemical Company, New York, N.Y.
Stewart-Warner Corporation, Chicago, Ill.
Sun Oil Company, Philadelphia, Pa.
Union Carbide & Carbon Corp., New York, N.Y.
United-Carr Fastener Corp., Cambridge, Mass.
United States Rubber Company, New York, N.Y.
Universal Match Corp., Ferguson, Mo.
Vitro Corporation of America, New York, N.Y.
Vulcan Copper & Supply Co., The, Cincinnati, Ohio
Warner-Chilcott Laboratories, Morris Plains, N.J.
Weatherhead Co., The, Cleveland 8, Ohio
Witco Chemical Company, Chicago, Ill.
Wyandotte Chemicals Corp., Wyandotte, Mich.
Zaremba Company, Buffalo, N.Y.
Zenith Aircraft, Div. of Zenith Plastics Co., Gardena, Calif.

Companies listed in bold face type are Sustaining Members

Speakers and officials for the afternon session of A.F.C.A. at Kresge Auditorium, Massachusetts Institute of Technology, June 14. Front Row, Left to Right: Mr. Albert E. Forster, Dr. James R. Killian, Jr., Maj. Gen. William M. Creasy, Mr. Harry A. Wansker, Brig. Gen. Clifford L. Sayre. Back Row, Left to Right: Dr. Joseph Kaplan, Dr. Simon Ramo, Dr. James F. Black, Dr. Per K. Frolich, Mr. Chenery Salmon, Boston, Treasurer of the meeting; Dr. Harold Weber, Professor, Dept. of Chemical Engineering, M.I.T., and a Director-at-Large of A.F.C.A.

A. F. C. A. ANNUAL MEETING SPEECHES

A.F.C.A.'s 11th Annual Meeting in Boston brought forth some very notable speeches. Those of which manuscripts were made available are printed herein in full. Following are thumb-nail sketches:

DR. PER K. FROLICH, speaking at the morning session June 14, gave a much-needed and very readable account of the Chemical Corps' new organization which reflects largely the Miller Committee recommendations.* The latter half of his talk, especially interesting, is an expression of personal views by Dr. Frolich on the Chemical Corps' mission and program. With respect to his now full-time status with the Corps he answers the charge once made to him, "You Frankenstein."

MR. ALBERT E. FORSTER, president of the Hercules Powder Company, presided at the afternoon session on June 14 at Kresge Auditorium, M.I.T. While not listed as one of the meeting's speakers, his apt comments, interpolations and biographical sketches added up to one and his participation certainly was a major part of the afternoon's program.

DR. JAMES R. KILLIAN, JR., president of M.I.T., had been billed in the advance notices of the meeting only for a few words of welcome to A.F.C.A., but he added to that materially, philosophizing somewhat on ways and means of achieving greater progress in technology. He complimented A.F.C.A. for aiding in good government—industry relations and, with respect to the technical manpower problem, proposed a top-level survey and report to promote popular understanding of needs and objectives.

DR. JOSEPH KAPLAN, National Academy of Sciences, chairman for the United States program in the International Geophysical Year, gave a necessarily long but most informative and interesting account of the I.G.Y., its scope and significance. Laymen will not need to have technical dictionaries at hand for easy reading of Dr. Kaplan's speech which includes information about rockets and satellites.

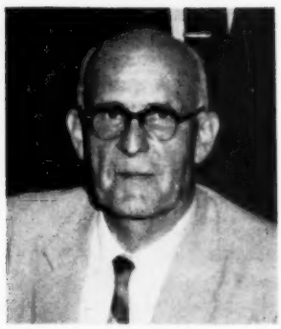
DR. SIMON RAMO, executive vice-president of the Ramo-Wooldridge Corporation, Los Angeles, gave a thought-provoking discussion of human society of (seemingly) the not too distant future resulting from current trends in technology. He pointed to the need for a "synthetic intelligence" to cope with the technological complexes involved and predicted the "three-dimensional" or space living people and human capability to wipe out or destroy the earth.

DR. JAMES F. BLACK, Esso Research & Engineering Company, gave a talk illustrated with slides on "Oil and the Atom." Dr. Black viewed the oil industry and the coming industry in atomic power as partners rather than competitors in supplying the world's energy requirements. He referred to the extensive use of radioactive materials by the oil industry for such matters as radioactive tracers.

CAPT. FRANCIS E. BARDWELL, commanding officer of the *U.S.S. Antietam* took the platform at the M.I.T. session to express a "welcome aboard" the aircraft carrier and accompanying destroyers in the Navy's program for the Association on the following day.

DR. CLIFFORD C. FURNAS, Assistant Secretary of Defense (Research & Development) the banquet speaker at the final gathering at Hotel Somerset June 15, spoke on relationships of chemistry and defense and emphasized need for increased basic research. He alluded to the impressive program of the Navy during the day aboard the *U.S.S. Antietam* and destroyers and also gave high praise to the Association for its recognition of the importance of increasing the nation's output of scientists and engineers.

*Ad hoc committee headed by Mr. Otto N. Miller, vice-president of the Standard Oil Company of California, reported upon in Sept.-Oct. 1955 issue.



THE CHEMICAL CORPS: BETTER MANAGEMENT FOR DEFENSE

Talk by
DR. PER K. FROLICH
Deputy Chief Chemical Officer for Scientific Activities

Mr. President, members of the AFCA, and guests:

AT YOUR MEETING last year, General Creasy outlined to you some of the thoughts behind his appointment of an ad hoc committee, which then was in the process of studying the mission and organizational structure of the Army Chemical Corps. Since that time, the committee has submitted its recommendations and, to a large measure, they have been put into effect. So much has already been said on this subject that those of you who are particularly interested, by now are well informed on the resulting reorganization and I shall not tire you with details of the new—as against the old—structural set-up.

I realize that looking at other peoples' organization charts and listening to their peculiar internal problems can be just as repetitious as the inspection of a chemical laboratory. Basically, most laboratories are the same in terms of benches, hoods, flooring, piping, and ventilation. Nevertheless, one usually finds some element of design which has been placed there to meet a particular requirement, so that most likely one comes away from such a laboratory tour with some new impressions and ideas for his own use. Much the same holds true for a review of specific organizational functions, whether one is dealing with industry or government.

With such thoughts in mind, I am going to refer to a simple chart depicting the present organization of the Army Chemical Corps. I am doing so as a means to an end, rather than an end in itself; for, I am going to use the chart largely to outline some *operational* features which I hope may possibly be of interest to you.

One may look upon the Chief Chemical Officer, Major General William M. Creasy, as the president of a corporation, or perhaps, I should say, the president of one of the subsidiaries of a vast corporation, for the Army Chemical Corps is not an autonomous organization. Following through with this analogy, one may look upon his Deputy, Colonel William E. R. Sullivan, as his executive vice-president. Also in this top executive group is a Deputy for Scientific or Technical Activities—your speaker, an Executive Director, Mr. Edgar A. Crumb, and an Executive Officer, Colonel J. C. Boyer.

Just under this top management level are the activity commanders. One might consider the vice-presidents for Research and Development, for Engineering, for Materiel—which includes the production or manufacturing and purchasing functions, and a vice-president for Plans and Doctrines—an area which includes personnel, training, and planning.

Then there are the various staff functions which report in at appropriate points, more or less as special assistants to the president.

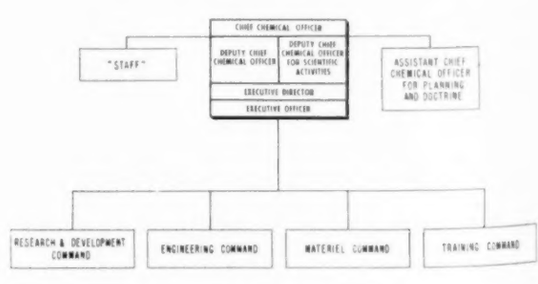
VIEWED IN THE LIGHT, the new Chemical Corps structure bears a striking resemblance to an industrial organization. In fact, in many respects, it operates like a good-size chemical firm. Thus is a pattern made necessary by our position as a militray-industrial organization. For, while we are a military agency and perform a great deal of work purely of a military nature, we also have responsibilities in fields that are industrial-like in nature—i.e., research and development, engineering, manufacturing and purchasing.

It might be well, also, to note that the new, or revised, organizational concept places strong emphasis on the military-civilian team. Of the four people immediately associated with the Chief Chemical Officer, two are civilians, and the concept of civilian deputies is carried down throughout much of the organization. This is particularly true in the fields of research and development, where Dr. John L. Schwab is Deputy to General Rothschild of the Research and Development Command, and in engineering, where Mr. Louis E. Garono is Deputy to Colonel Allen of the Engineering Command.

The Chemical Corps continues to be responsible for providing the agencies of the Department of Defense—the Army, the Air Force, the Navy, and the Marines—with the means of defending themselves against attack from chemical and biological weapons. And, we are still coordinating our items, ideas, and doctrine for the use of the Federal Civil Defense Administration and the U.S. Public Health Service wherever feasible.

I realize that you have heard and read much through your Association how the Chemical Corps goes about accomplishing this mission. As we are here for an exchange of ideas, however, it is possible that some repetition may be permissible in the hope that this may lead to the germination of new ideas which will be of mutual benefit. We in the Corps are always happy to receive from our industrial friends ideas that may lead to an improvement in management or to a better product.

As in most industrial organizations, ideas can originate at any level inside the Corps or outside but means must be provided for recognizing those ideas and incorporating them into plans and programs which will culminate in new end items, either defensive or offensive. Planning



of this nature in the Chemical Corps is the responsibility of the new Assistant Chief Chemical Officer for Planning and Doctrine, Brigadier General William R. Currie. In addition to his own staff, Gen. Currie has the facilities of the Chemical Corps Board and of the Chemical Corps Field Requirements Group to assist him in the formulation of military and doctrinal plans. These plans, together with the military characteristics of items required by consuming services, form a basis for our research and development program.

IT HAS BEEN within the research and development area that the major reorganizational changes have taken place. The new Research and Development Command has a lateral type organizational structure at the working levels, and a smaller headquarters with broad guidance responsibilities. Such an industrial management-type structure, rather than the normal military pyramid-of-command-type organization, seems best suited for this area of activity.

As the fields of biological and chemical warfare are relatively new, and progress in the fundamental aspects is rather rapid, the research and development function represents a major portion of the Chemical Corps effort. The importance of the Corps' research and development responsibility in performance of our mission was pointed out rather emphatically by the ad hoc committee, and the recommendations along this line influenced our reorganization to a major degree.

To accomplish the research and development responsibility, we now have the Research & Development Command under Brigadier General Jacquard H. Rothschild. Under him are three operating agencies: the Chemical Warfare Laboratories at the Army Chemical Center, Maryland, of which the Medical Laboratories are a part; the Biological Warfare Laboratories at Fort Detrick, Maryland; and the Dugway Proving Ground in Utah.

The commanders of these three installations are all military men, but it may interest you to know that the present incumbents all hold Ph.D. degrees, and each has provision in his organization for a civilian Deputy for Technical Operations. Among them, they are authorized some 1,400 professional personnel and about 4,000 others. In addition, there are assigned to these three installations some 260 officers and approximately 1600 enlisted men (half of them professionally trained, the so-called ESPP's). As you can see, this is a sizable research and development effort.

Naturally, the management of a research and development organization of the magnitude of about 7,000 persons entails many problems. Most of you have to live with the same problems. They can be traced to three main factors—money, facilities, and personnel.

Like any government agency, the Chemical Corps must, through the Department of Defense, look to Congress for its money. And, while we, in recent years, have been faced with a certain amount of belt-tightening, we still are responsible for the efficient utilization of large amounts of money each year.

An additional problem has been to achieve and maintain the flexibility required to operate efficiently. I am thinking specifically of the difficulty we experience in achieving the best possible balance between *in-house* research and development work and that work which is let out on *contract*. Normally, we would like to contract somewhere in the range of twenty to twenty-five percent of our research and development effort to industry, the universities, and other research facilities. While, at times, our contract figure has reached the point of about one-third of our research and development budget —principally due to carry-over and long-term projects —there are times when we have difficulty maintaining a figure of twenty percent which we feel should be the absolute minimum. This has been because of budgetary reductions which have occurred on short notice. To effect these reductions in the time required has left us virtually no choice but to reduce the amount of contract work—often on short notice. It is not a situation to our liking, and certainly not to the liking of our research contractors, but to have attempted to do this internally would not have effected the required dollar reductions within the time specified by higher authority.

OF THE THREE normal problem factors (i.e., money, facilities and personnel) the one concerning facilities is the least bothersome at this time. We are fortunate in having excellent physical facilities in which to accomplish our research and development work, and we expect these to improve with the completion of several new buildings within the next year and a half.

Like industry, however, we have our share of personnel problems. It certainly is not news to any of you that competent professional personnel are in extremely short supply in this country today. And, we are in no better position to attract and hold good people than are you. As a matter of fact, in some respects we are at a disadvantage in that we cannot compete directly with industry in the matter of salary.

However, we can, and we do, offer some inducements which partially offset the difference in salary, and these inducements have helped us to maintain a highly efficient core of scientists and technicians to manage and operate our research and development work. One of these inducements is that our work offers opportunity to engage in problems which are challenging and vital to the national interest, and which often lead to benefits for every-day life aside from their military aspect. Another inducement is the opportunity to work in the best laboratories, where consideration of safety is a matter of prime importance and is integrated into each operation. Despite the fact that much of the work is in areas where materials toxic to humans must be used, our accident rate is lower than the last published average for "All industry" and of the total chemical industry. In this connection, all of us are most gratified to learn that the Chemical Corps has been presented with the National Safety Council Award of Honor for Safety for 1955. Then too, there is a greater freedom than is generally recognized to publish the results of non-classified research and so earn professional stature as a result—for instance, last year the Corps' own scientific personnel and its contractors published some 600 technical papers. We have a fairly liberal policy for attendance at scientific meetings, and the opportunity for a person to work with some of the outstanding leaders in a particular scientific field often is an added inducement. By this I do not mean to imply that we are perfect but, rather, that things are "looking-up."

The Civil Service leave and retirement policies have also proven to be factors in holding the type of personnel we require. And so I feel that we have been quite successful in obtaining the services of highly competent chemists, physicists, microbiologists, all types of engineers and members of related scientific disciplines. But nevertheless, we constantly face a manpower shortage, especially among the professional personnel.

The Research and Development Command is responsible for all basic and supporting research and the development of an item through the so-called prototype or

(Continued on page 49)

Address by

DR. JAMES R. KILLIAN, JR.

President of Massachusetts Institute of Technology in welcoming talk to A.F.C.A. visitors suggests new approach to the technical manpower problem

"MY MISSION is not to make an address; it is to express our special delight here at M.I.T. to have you meet in our facilities and to have the chance to meet you. Some one has said that this, being the commencement season, is the period of maximum 'fall-out' in the United States—fall out of oratory and advice. And, just having been through several commencements, I am still trying to avoid this hazard and I will venture just a few remarks.

"First, may I say how much I think this kind of organization can do for our armed services. It is vital for industry and military representatives to come together jointly to tackle some of the very difficult problems that we face at the present time, particularly in the range of interest represented by this association.

"We need to give particular attention to several different aspects of our national security at the present time. First of all, our great national crisis at the present time is the shortage of talent. I say, 'shortage of talent'—I rather mean the use of the talent that we have, its proper education, its proper development over the whole range of activities that we must take care of in our industrial activities and in our defense activities. One of the most pressing needs that we have in the United States at the present time is to try to get a comprehensive view, a thorough understanding of how we deploy our scientific and technical resources. I have suggested that we might find a means in this country to draw a master plan that would help develop better public understanding of what major technological objectives are—what the priorities are that we must deal with at the present time in the use of manpower. And I have suggested that we need something on the order of the famous study that was made some years ago and reported on in 1948—the so-called Finletter Report on national air policy, entitled 'Survival in the Air Age.' It seems to me that if we could pull together a comparably thorough report under the general title 'Survival in the Age of Technological Contest,' we might go a long way toward sharpening up the public's understanding and the understanding of professional groups of what the priorities are in our present situation.

"The second thing is to give careful attention to the problem of our decision-making processes—how we expedite moving from a basic scientific discovery to a piece of hardware—how we reduce the lead time in all of the weapon developments that we undertake, particularly in a period which I do not need to stress, where we are dealing constantly with the problem of being in a constant state of readiness. This problem of how we shorten the time that we must take in the development of our major weapons, is one of the great problems that we now face.

"There is another one, which Mr. Ramo is going to talk about this afternoon, that is crucial at the present junction—the impact of technology on organization. By this I mean the effect of great systems, technological systems, on the organization of our industry, our defense department, and on our society.

"It is becoming increasingly clear that technology is going to affect profoundly our social organization and all of its components in the years ahead. It is going to affect particularly our industrial and our military organizations. The whole problem of integration, of how we adjust all of the components of a great system to make sure that they work as part of the system, and that the whole system works effectively is one of the very subtle and very philosophical managerial problems that we face at the present time. And I think a great deal of our present discussion in this country about the problems of military organization, as well as other kinds of organization, derive from this problem—this impact of technological systems on our managerial and organizational methods.

"A final problem of vital importance, particularly in the area of defense, at the present time, is how our government, how our Defense Department, maintains a root system which draws sustenance from the entire civilian domain of science. This has to do with the whole process of how government informs itself at all times, about the fundamental developments in the field of science and perceives the importance of these developments on weapon technology.

"I don't think that we have wholly solved this problem, although there has been an enormous development since the war. This group, of course, well knows this and is a participant in the maintenance of effective civilian contact and relationship with the Department of Defense.

"But I would suggest that we need to give more careful study to the functions of the adviser in government—how he maintains his consulting relationship with the agency of the government he is serving, and what the limitations are on his function as a civilian adviser and a consultant. We do not have a creed developed in the United States with respect to the government consultant in the way we have with respect to the engineering consultant and his client. This is a very interesting area for further study and further development.

"There is a wonderful opportunity in our kind of democracy for encouraging still more participation in our government processes and our defense planning and in the utilization of more of the able civilian minds of the country. We have been very successful in this so far, but we have just begun to understand the full potential that we have available to us in this kind of employment of our resources."

* * *

In concluding his remarks, Dr. Killian said he had had opportunity some years ago of witnessing an extraordinary manifestation of this sort of cooperative effort in

respect to an urgent classified technological project. It involved brilliant staff work by a dozen or so scientists and engineers, "each probably the greatest expert in the world in his own field, all working anonymously as a team. . . .

"They broke across all departmental lines and cut through red tape in ways available to no government officer," he stated. "They mobilized a group of industrial companies and each of these industrial companies made its best man available . . . and the most creative and advanced work of which they were capable. . . . Why did they do it? Because they were imbued with the spirit of American science, American industry, the philosophical belief that we can wrest from nature what we want and need; that obstacles are made to be circumvented; that America can win the technological race because it freely uses the talents of its citizens and its organizations and that a government and a democracy that is characterized by this fluid flow of ideas in and out of government and by this questing and zestful outlook on life is a government and country that can accomplish most any objective it sets out to do. . . ."

WEAPONS SYSTEMS ENGINEERING AND CHANGING ROLE OF THE SCIENTIST

By Dr. Simon Ramo

(Following is a resume of the address by Dr. Ramo, who is Executive Vice-President of the Ramo-Wooldridge Corporation of Los Angeles.

THE DANGER that social progress will not keep pace with scientific progress in the highly automatized world of the future was high-lighted by Dr. Simon Ramo, executive vice-president, The Ramo-Wooldridge Corporation, Los Angeles, discussing "Weapons Systems Engineering and the Changing Role of the Scientist," before the 11th Annual Meeting of the Armed Forces Chemical Association, on June 14. Dr. Ramo spoke at the afternoon session of the Association held at the Kresge Auditorium of the Massachusetts Institute of Technology, in Cambridge, Mass. Dr. Ramo said, "We are heading for a world in which these three factors could be the most important of all influences in our daily lives:

"(1) Man will have learned so much about nature's forces and their control that he will have the power to virtually destroy the earth.

"(2) Our society will be 'automatic' with communications, transportation, and production so fast, vast and complex that man's physical world must be designed for a minimum of participation by man—not only his muscles but even man's brains and senses must stay out of the act." In this connection he referred to the need for a "synthetic intelligence" to assimilate and cope with technological matters beyond the capacity of the human brain. He cited the current problem of airline traffic control as exemplifying a need, even now, for such intelligence.

The third factor which Dr. Ramo cited was the conquest of space will make us a "three dimensional people" with control not only of the earth, but of all the space surrounding the earth.

In his speech, Dr. Ramo, internationally known as an authority in the fields of electronics systems, guided missiles and automation, explored "this changing society from the standpoint of the engineer and scientist, their role in the transition, and the impact that the transition is having on industry and education."

"The full fledged attainment of the automatic society represents an enormous engineering task," he pointed out, naming the shortage of scientists and engineers as one bottleneck in its achievement, and the difficulty of arranging to get things done as the other equally important bottleneck.

"Between who will decide what is to be done, who will do it, and who will pay for it, the arrangement-making problem appears so challenging it is sometimes easier today to bring together the group of technical experts than to solve the arrangement-making problem," he said.

Commenting on the shortage of scientists and engineers, Dr. Ramo said, "It is real. It is going to get worse. No chance appears to exist for the number of scientists graduating per year to be increased to a rate sufficient to cause an oversupply. . . . The most conspicuous shortage," he added, "will be in . . . systems engineering."

"Systems engineering" he said, "is the engineering of the whole as against the engineering of any one of its parts. It means surveying the entire technical problem rather than only one or two of its component parts."

He pointed out that a wider range of talents will be needed in a systems engineering staff, because of its complexity and the number of inter-related fields it can cover.

Furthermore, Dr. Ramo stated that scientific experts alone will not be sufficient, because the new systems involve people and organizations in such an intimate way that economists, business-procedure experts, and psychologists are needed.

"The top systems engineer (the director of the project) must have certain qualities of leadership and managerial ability, must understand people. . . . In addition, he must be technically broad enough to be able to appreciate all phases of the project and . . . be capable of organizing it in such a way that the various individuals . . . can work harmoniously to bring off the desired result," he said.

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"The assignment of technical people to managerial positions is an inevitable consequence of the increasingly technical nature of our industrial operations."

Dr. Ramo added, "This does not mean that engineers and scientists will some day take over and run industry." He said, "probably a much more accurate prediction is that the manager of the future will be trained with greater emphasis on science."

"We have reached the point in our knowledge of science where man, by applying the discoveries of science, can radically change the world during the scientist's lifetime," Dr. Ramo said. For this reason "a study of what man can do deserves equal significance with the study of nature's additional secrets."

"We must," he said, "and hopefully we will, both apply man's knowledge to alter the world and find out additional information about the nature of the world."

OIL AND THE ATOM

By DR. JAMES F. BLACK

Physical Chemist, Esso Research and Engineering Co. at Linden, N.J.

Following is a resumé of Dr. Black's address, which was extensively illustrated with slides.

Future developments of atomic energy will have beneficial effects upon all industries and upon the standards of living in many parts of the world. These effects can readily be visualized by considering the impact of atomic energy on the Oil Industry. Oil and the Atom are naturally linked, because each has important applications for energy production. In the long-term outlook, however, these energy sources will be partners, rather than competitors, in supplying the world's energy requirements.

The principal products from nuclear reactors are heat, radiation and radio-active materials. Considerable attention is being given to using the heat output from reactors for electrical power production. This heat should also prove useful for the propulsion of naval vessels and military aircraft. It is extremely doubtful, however, that atomic energy can ever be used for automobile propulsion or for home heating. For these reasons, atomic energy will compete directly for only a small percentage of the petroleum market. Also, in the long-range outlook, the world's energy requirements are increasing at such a tremendous rate that the oil industry will welcome the assistance of atomic energy to help satisfy these demands.

It is entirely possible that the most valuable products from nuclear reactors may be radiation and radio-active materials, rather than heat or electricity. Research now in progress suggests that nuclear radiation may prove very useful as a driving force in processes for the manufacturer of chemicals, plastics and petroleum products. Radio-active materials produced in nuclear reactors are being used in ever-increasing quantities for obtaining better control of manufacturing processes, for more efficient operation of industrial equipment, and for many types of research. The petroleum industry has been a leader in devising valuable new uses for radiation and for radio-active materials. It should realize even greater benefits from atomic developments in the years ahead.

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BIOLOGICAL EFFECTS OF ATOMIC RADIATION

(The following is condensed from a news release by the National Academy of Sciences, Washington, D.C.)

WASHINGTON, D.C., JUNE 12—The National Academy of Sciences, in releasing a report on a year-long study of the biological effects of atomic radiations, warned today that radiation from any source—bombs, nuclear reactors, the natural environment and medical X-rays—is harmful to life. The report emphasized that exposure of individuals and of the world's population as a whole should be carefully controlled, and it recommended that individual records be kept of the lifetime radiation exposure of all persons.

With proper safeguards, the report states, a full-scale, worldwide peaceful atomic energy program should not bring with it undue biological hazards.

The report makes clear that of the body's physiological systems, the inheritance mechanism is by far the most sensitive to radiation. Any radiation, no matter how little, which reaches the human reproductivecells can cause mutations (changes in the material governing heredity) that are passed on to succeeding generations. Human gene mutations which produce observable effects are believed to be almost always harmful.

For these reasons, the scientists recommend a limit on the amount of radiation reaching people's reproductive glands over and above the amount they receive naturally from cosmic rays and radioactive deposits. This limit, as an average, is set at 10 roentgens from conception to age 30. Some individuals will receive more than the average for the entire population, but the recommended individual maximum is 50 roentgens to age 30 and an additional 50 between the ages of 30 and 40. (An average dental X-ray, for example, delivers 5 roentgens to the patient's jaw but only five thousandths of a roentgen of stray radiation to more remote parts of the body such as the sex glands.)

At present, the report states, the average U. S. citizen is getting in his sex glands about three roentgens in medical and dental X-rays, or 30 per cent of the recommended limit.

The scientists propose that records should be kept of the total accumulated lifetime exposure of every person and that the use of X rays should be reduced as much as possible consistent with medical necessity.

The report stated that atomic weapons testing has not raised worldwide radiation to biologically dangerous levels and will not do so if continued at the same rate as in the past.

The report pointed out that fallout from weapons tests has already produced measurable but harmless contamination in food supplies and in the bones of people. Potentially the most damaging radioactive substance involved is strontium 90. Any large increase in the rate of release of this material might be a matter for serious concern.

There is no evidence that atomic weapons tests have affected weather or climate.

When a worldwide atomic power industry becomes fully developed, the report points out, its accumulated radioactive waste products may represent more radiation than would be released in an atomic war. The prevention of widespread contamination, which might expose large numbers of people to dangerous radiation, depends on man's ability to keep these wastes out of the great network of ocean and air currents, food and water supplies, upon which he depends for life.

The scientists also state that radiation from fallout inevitably contaminates man's food supply. At present this contamination is negligible but the maximum tolerable level of radioactivity in food is not known.

The study committees recommended that:

We should develop improved techniques to monitor worldwide fallout.

A national agency should control and keep records of all dumping of radioactive material in the nation.

An international body should set up safe standards without delay for the marine and air disposal of radioactive materials.

Research in marine disposal of radioactive waste should be on a cooperative international basis.

Until advances in reactor technology lessen hazards substantially, reactors near populated areas should be sealed against the release of radioactive materials in the event of an accident.

We urgently need accelerated research in the problems of: genetics; radiation pathology; mixing between various parts of the atmosphere and the oceans; the concentration of radioactive materials by plants and animals; geophysical and geochemical aspects of the ultimate disposal of radioactive wastes; selection of biologically suitable sites for atomic facilities; and safety devices for the control of accidental power surges in reactors.

If, through careful control of all atomic activity, general exposures to radiation are limited to what geneticists consider reasonable, there should be no direct ill effects on the people who receive the radiation. Larger exposures, however, of 100 roentgens and up, when delivered in a single dose to the whole body are harmful. But much higher doses may be safely delivered to limited parts of the body under controlled conditions of medical treatment.

One of the pathological effects of radiation is a general increase in the rate of aging and a consequent shortening of life. Dose levels such as the geneticists believe reasonable, or as have been established for persons working with radiation, have not been shown to have this effect.

Radiation can enhance man's food supply through solution of practical problems in the use of fertilizer, the production of new and superior strains of food plants by mutations, and the sterilization of packaged food with reduction of the need for refrigeration and extension of shelf life of many products.

Research through radioactive tracer materials offers promise to chart ocean and air currents, and to study the interrelationships of marine animals. Such investigations may be possible only within the next 10 to 20 years since increasing radioactive contamination of the sea and atmosphere may make detection of these tracers impossible.

The finding announced were made possible by financial support from the Rockefeller Foundation. The Atomic Energy Commission and the Department of Defense cooperated in the continuing study; the reports, however, are private and independent.

IGY—

THE INTERNATIONAL GEOPHYSICAL YEAR

By **Dr. Joseph Kaplan**

U.S. National Committee for the IGY
National Academy of Sciences

The recent advances in theoretical and experimental methods for studying our physical environment have been concurrent with a rapidly growing interest in these problems. This interest ranges from that of the physicist or chemist who derives knowledge regarding the common elements oxygen, hydrogen and nitrogen from a study of their behavior in the aurora and airglow, to the glaciologist and seismologist, who will be able to assess the amount of ice by studies in the Arctic and Antarctic. This wide range of theories, techniques, and interests, affecting every facet of our lives and of increasing significance to our defense, will be brought to an unprecedented climax during the International Geophysical Year, 1957-58 (IGY). Simultaneous investigations will be made all over the world of the earth's interior, its crust and oceans, of the complex atmosphere reaching from the surface to outer space several hundred miles away, and of the sun, which virtually controls life and events on our planet.

Throughout the world some 5,000 scientists and engineers are preparing for this intensive investigation of the earth, the atmosphere and the sun. Into the 18 months of the IGY will be compressed a score or more of years of normal research as scientists attempt to get a unified picture of our physical environment. During the IGY scientists will explore almost every major land and sea area. They will study the earth's core and crust. They will probe into its interior with explosion sound waves and send rockets and satellites to explore the high atmosphere and outer space. They will measure the deep ocean currents and the surging tides in the seas. They will observe and measure the many mysterious particles that continually bombard the earth from outer space.

Answers to a thousand questions will be sought. Is the climate of the earth changing? Are the glaciers receding? Will melting ice sheets some day flood coastal lands? Where do cosmic rays come from and what is their nature? What causes the aurora? What is the relationship between sunspots and solar flares and long-range radio transmission? These and many other questions are the objectives of the IGY program. They are important to man's understanding of the earth and the universe surrounding him. The answers will provide him not only with new basic knowledge, but applications in many fields of human activity—from trans-polar air travel and the raising of crops to better radio communications and navigation.

At the present time, 48 nations are formally participating in the International Geophysical Year: Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Bulgaria, Canada, Chile, Chinese Peoples Republic, Colombia, Czechoslovakia, Denmark, Finland, France, Germany (East), Germany (West), Great Britain, Greece, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Mexico, Morocco, Netherlands, New Zealand, Norway, Pakistan, Panama, Peru, Philippines, Poland, Portugal, Rumania, Spain, Sweden, Switzerland, Tunisia, Union of South Africa, USSR, United States, Uruguay, and Yugoslavia. An additional ten to twenty nations are expected to participate or cooperate in the program.

The importance of the program stems in large part from the nature of our planet and of the universe about us, which establish the environment in which we live. Many features of this environment, particularly those relating to the atmosphere, are caused or affected by the sun, and the events themselves are world-wide in nature. For these reasons better understanding and major advances in geophysics require coordinated, world-wide studies, especially since many of the disciplines are inter-related.

Probably the most easily recognizable illustration of the world-wide nature of geophysical events is that of weather. Storms forming off the east coast of Asia may cause a cold wave to surge over the United States a week later, which may in turn create a new storm in the mid-Atlantic and subsequent floods and snow avalanches in Europe. Solar flares, erupting from the sun and reaching out 100,000 miles away from its surface, create magnetic disturbances and result in radio communication failures. Such events exert a controlling influence on the daily lives and activities of all individuals and affect commerce and industry, the conduct of land, sea and air travel and transportation, and the range and reliability of radio communication and navigation systems.

The program of the United States has been planned by the Nation's leading geophysicists, gathered together

Presented before the Armed Forces Chemical Association, June 14, 1956, Boston, Massachusetts.

by the National Academy of Sciences. This program includes projects in the thirteen disciplines and areas of activity involved in the IGY: aurora and airglow, cosmic rays, geomagnetism, glaciology, gravity, the ionosphere, longitude and latitude determinations, meteorology, oceanography, seimmology, solar activity, and rocket and satellite studies of the upper atmosphere. The U. S. program will include activity within the continental limits of the United States, Alaska, the Antarctic, the Equatorial Pacific, the waters of the Atlantic and Pacific, and various cooperative efforts with nations of the North and South Americas.

A complete description of the program would be impossible in the time available to me here. I will therefore first touch on some of the more general features of the program by pointing out that even though many of the fields are inter-related, it is possible to arrange them into groups which are most closely related to the earth's supply of heat and water; to the upper atmosphere and its interaction with the sun, and to the earth's crust and core. In addition, no description of the IGY program would be complete without a description of the proposed use of rockets and satellites during the IGY. Also, special mention must be made of the IGY activities in the relatively inaccessible Antarctic in which so much public interest has been developed. And finally, we must say a word or two regarding the organization of the U. S. program and the remarkable cooperative effort that it represents.

THE EARTH'S WATER occurs largely in three forms: in the oceans, seas, lakes, and rivers, in frozen form in glaciers and snow and ice sheets, and in vapor form distributed throughout the atmosphere. There is a continuous process of interchange among these depositories of water, and this process is related to the heat budget of the earth and the circulation of the atmosphere. Simultaneous studies in oceanography, glaciology and meteorology have as one of their primary objectives the study of these heat and water inter-relationships which determine in large measure weather and, over a longer period of time, climate.

With every advance in civilization, knowledge of weather patterns has grown increasingly important. Man's mode of living, the shelter he constructs, the clothes he wears, his trade and commerce, and to a large degree the very food he eats are related to the weather. Reliable prediction is one means of coping with the weather; and the improvement of forecasts, particularly their extension in time, is an important objective of meteorologists the world over. Weather is a global entity. The atmosphere is the "working fluid" of an enormous heat engine driven by the sun. Large and small scale circulation systems in the atmosphere transport heat from the tropics to the polar regions.

One of the principal deficiencies in understanding weather and in its prediction has been the lack of adequate data from the Southern Hemisphere, particularly in the Antarctic and in the vast oceanic regions surrounding it. During the IGY almost 60 stations will be established in the Antarctic and the sub-Antarctic waters. These, combined with other stations in the Southern Hemisphere, will provide adequate meteorological coverage of the Southern Hemisphere for the first time in history.

Both in the Northern and Southern Hemispheres emphasis is being placed on meteorological measurements to heights of approximately 100,000 feet. An extensive chain of stations throughout the world will launch balloon-borne weather instruments. These devices will radio back information on pressure, temperature, humidity, and winds. This information promises to reveal the true three-dimensional structure of the atmosphere which is needed for improved long-range weather prediction as well as for an advance in our knowledge of basic weather patterns.

The atmosphere is responsible for a number of factors crucial to life: oxygen, moisture, insulation against deadly radiation from the sun. No property of the atmosphere, however, is more important than its motion. Winds distribute heat from the tropics to other regions, transport moisture from the oceans and drop rain on the continents, remove polluted air from the cities and bring in clean air. In a windless world the tropics would become intolerably hot and the rest of the planet unbearably cold. The parched continents would become dust, cities would suffocate. The general circulation of the atmosphere keeps the air moving rapidly over the globe day in and day out, year in and year out.

ONE OF THE MAJOR studies of this program has to do with the mass movement of atmosphere between the tropics and the polar regions and with the circulation of the atmosphere around the world. Five meridional chains of stations will be used. Three of these reach from pole to pole—along the 80°W, 10°E and 140°E meridians. These chains will permit the study of major atmospheric circulation patterns and are expected to shed light on the exchange of heat between the tropics and the poles and the nature of mass movements in the air, including such features as the jet streams.

The Antarctic program will permit us for the first time to prepare daily weather maps of that huge continent. The Antarctic covers some six million square miles. Sheathed in ice and snow, this continent represents a unique region of cold weather, which is suspected to have a major influence on the world's weather.

Besides giving up food supplies and mineral treasures and serving as highways of commerce, the seas, because of their vastness, may prove to be a convenient repository for radioactive wastes of our new atomic age. If this possibility is to become a reality, however, we must have exact and detailed information about the structure of the oceans, the current systems, the stability of the deep water masses, and many other oceanic processes. In this respect, no amount of information can be too large or too great in detail: engineers and scientists cannot afford to take chances where it involves our whole civilization.

Human beings during the next few decades may, almost in spite of themselves, be doing something that will have a major effect on the climate of the earth. I refer to the combustion of coal, oil and natural gas by our world-wide industrial civilization, which adds carbon dioxide to the atmosphere. Estimates by the United Nations indicate that within the next 50 years we will have produced 1,700 billion tons of new carbon dioxide from combustion of industrial fuel. This astronomical amount is 70% of the carbon dioxide now in the atmosphere. In this way we are returning to the air and the sea the carbon stored in sedimentary rocks over hundreds of millions of years. From the standpoint of the meterologists and oceanographers we are carrying out a tremendous geophysical experiment of a kind that could not have happened in the past or be reproduced in the future. If all this carbon dioxide stays in the atmosphere, it will certainly affect the climate of the earth, and this may be a very large effect. The slight general warming that has occurred in norther latitudes during recent decades may be greatly intensified, with all that this means for the development of northern lands and waterways. Before we can make any confident forecasts about

(Continued on page 44)

MOLECULES—MILITARY AND CIVILIAN

Address by

HONORABLE CLIFFORD C. FURNAS

Assistant Secretary of Defense (Research and Development)

Before The Armed Forces Chemical Association
Boston, Mass., June 15, 1956

I AM VERY HAPPY to participate in the annual meeting of your association. I found the visit to Quonset Point and the *U.S.S. Antietam* very refreshing and interesting. It has also been a great pleasure to be with the high school students which your organization and its associated industries have very commendably invited to take part in your convention.

Now I feel certain that our high school guests know from the study of Chemistry that, in fact, molecules do not have little labels on them. At least microscopes and experimental evidence have not yet found military or civilian labels. There are, nevertheless, many developments in the field of chemistry and elsewhere which were generated by civilian needs. Nitroglycerin was discovered by Sobrero some 20 years before Nobel conceived the idea of linking the liquid explosive nitroglycerin with an absorbent material. Prior to Nobel's discovery nitroglycerin had been of little practical value due to its sensitivity to ordinary shock. Nobel's discovery was essentially civilian in nature. Dynamite has been of tremendous importance in the advancement of civilized nations and has been one of the most constructive of tools. It has probably been the most important explosive and the one to which our explosive industry devotes the bulk of its equipment and efforts.

Likewise the silicones which now form the basis of lubricants for jet engines as well as many other military applications had their origin in civilian sponsored research and development in chemistry.

Now it has not been universally true that most of these things were the result of the adaptation to military purposes of items which originated in the civilian economy, but in chemistry it was generally true that the military did take the discovery after development and convert it to military needs.

The enormous development of industry, based on the fixation of atmospheric nitrogen and the use of chemical compounds, is thought by many to have started after the outbreak of World War I in 1914. However, at least two of the processes which reached an important state of productive capacity during the war were already highly developed at the outbreak of the war, and the third process was operating at least in the pilot plant stage. The industry, while receiving a tremendous impetus during the war period, nevertheless had been on a well developed commercial basis long previously. The war forced intensive construction programs based on already well proven processes when, in 1915, Germany and Austria were forced to look elsewhere for their supply of nitric acid when the importation of Chilean nitrate was impossible.

Synthetic rubbers were known in several forms before World War II. However, it was the restriction of war time shipping that led Germany, in the 1914-18 period, to turn to its production. The methyl rubber of the World War I German synthetic industry assumed considerable importance to them but in quality it was, of course, not comparable to later day products.

Other synthetic rubbers were developed and placed into production during the period between the two world wars. However, for the most part the availability of natural rubber inhibited the all-our development of a synthetic rubber industry. The growing knowledge of polymerization with the resulting control of the synthetic quality and the capability of designing custom built synthetics for specific uses resulted in an active but small synthetic industry. Items like koroseal, vinylite and flamenol, to mention a few of the vinyl compounds, found extensive commercial application because of their special properties of outstanding chemical resistance to acids and to weathering. However, rubber had been proved as an extremely versatile material and had no serious competitor in its general field of usefulness for over a century. It was not until the unavailability of crude rubber generally to both sides in World War II that the synthetic rubber industry took permanent root. This pattern was not peculiar to the chemical industry but was quite general across the board. The vacuum tube in radio communications had been developed and was in widespread use prior to 1914. However, it was the impetus given by the war time requirements for military communications that resulted in transoceanic radio-telephone facilities by the encouragement the war time necessity gave to the developers and designers of radio equipment. The use of aircraft, too, in World War I accelerated the development of airborne radio communications. After the war, radio telephone communications took their place in our commercial civilian area.

The development and use of electronics for non-communication purposes was greatly accelerated by World War II.

In the past there have been some exceptions to this pattern. The story of black powder goes back many centuries—so far back that its origin is a matter of tradition. Its authentic history appears to have begun in the 14th century when it was first thought to be used for military purposes at the Battle of Crecy in 1346. It was not until 1627 that gunpowder is known to have been used in mining where it proved to be an excellent explosive for the blasting down of coal because its low velocity gives it a slow heaving action that does not shatter the coal unduly.

Napoleon, with military motives, induced French botanists to breed a certain strain of sugar beets so that his armies would not have to depend upon the West Indies for sugar. He also offered a prize of 12,000 francs for the most practical method of preserving food. Nicholas Appert won the prize for the process he had developed for packaging heat sterilized food in hermet-

ically sealed containers, the forerunner of the present tin can.

These latter items, which initially found primary usefulness in the military field, were exceptions to the rule. From the early days, right down to World War II, the military generally took items after their development in the civilian area. In many cases the acceleration to practical commercial purposes resulted from military interest and, in fact, the industrial production of many items dates back to the war time necessity but there was little support for military purposes of research and development from one end of the spectrum to the other.

World War II marked the rise of science and technology to a primary role in shaping the character and outcome of warfare. The rise of air power to a dominant position among the military forces was a part of the revolution of military science but the revolution was much broader than airplanes, it affected all arms. Scientific results were quickly brought into practical military use. Many items were developed specifically for military purposes; radar, proximity fuses, precision fire control systems and, finally, the atomic bomb were major factors in winning the war. Our very strong position in science and industry was the major foundation which allowed us to win the war and science and industry remain our most important assets in national security.

The advances in weaponry, based on science and technology, brought about a new era for us as a nation. In history it coincides with the rise of a hostile ideology —Communism—which has appeared to challenge the existence of the free democracies of the world. Almost daily pronouncement in the national press and countless speeches point out the implications and obligations in this uniquely difficult period of our nation's history. We must maintain a strong military posture as a deterrent against possible aggression and we must be prepared to win if World War III most unfortunately should occur. The direct cost of defense amounts to some 10% of our gross national product and this maintains, by far, the largest military force in any peacetime period of our history.

We must also maintain a strong and healthy national economy for the long pull. We must help other nations not only for military purposes, but to spread the benefits of democracy so that we can win and retain friends on the international scene. The United States has only 6% of the world's population, but we must do all these things. Allow me to say that I concur in this general outline of the task and I recognize that it is a chore which is burdensome, difficult and often frustrating—but we would be naive not to face the issue.

Probably in no other broad field is the military part of the total effort greater than in research and development. Here it has been estimated that close to 40 per cent of the research and development work under way in the country is supported by the Department of Defense and the military-related parts of the Atomic Energy Commission programs. All of this military-related work is not performed in the research and development laboratories of the military services—about 60 per cent of our military research and development funds actually is spent in support of outside contracts. Basic to our philosophy of conducting the military research and development program is the concept that we integrate our efforts in utilizing the best that the science and technology of the country as a whole can produce. Outside contracting provides the primary means for doing this. Of our total appropriation, 50 per cent is expended on contracts with industrial laboratories and 10 per cent on contracts with educational and nonprofit research institutions. The remaining 40 per cent is expended for government employees and for material and supplies used in goverment laboratories, as well as for the administration of the contractual work and the testing and evaluation of the fruits of all the laboratories both outside and inside the government. Thus we depend on industrial laboratories and outside contracts for more than three times the substantive work in research and development than is performed within the service laboratories.

Now in sponsoring so much research and development work there are many problems and we might take as a subtitle "Problems—Military and Civilian." Actually just as the molecules—civilian and military, are common to both fields, many of the problems confronting us in the administration of research and development for military purposes are common to the problems of industrial administrators. A basic and extremely difficult problem in defense is the determination of just how much money should be expended each year. Last year industrial organizations spent, on the average, amounts equal to almost 2 per cent of their sales for research and development. It was higher in some industries such as the chemical industry which is a commendable thing and it was lower in others because of complex factors and varied reasons which we need not explore here today. In the Defense Department the identifiable research and development appropriations requested for next year are about 4 per cent of the Defense budget, probably a reasonable ratio, judging from industrial practices.

In supporting a program that will maintain a technological margin over our potential enemies and allow the exploitation of scientific advances for weaponry, we do not want to spend more than can be used effectively since this might well produce no greater results.

On the other side of the coin is the necessity for maintaining an expanding civilian economy. Our struggle is economic and sociological as well as military. This balance between the military and civilian-related effort brings into consideration the nation's total capacity for research and development. Our present levels, over-all, appear to be a reasonable balance between the military and civilian requirements.

In addition to the fundamental problem of determining how much research and development expenditure is required to maintain our military posture and our civilian economy, there are many other problems which are common to both fields. One of these is that of manpower utilization, particularly in this era when skilled manpower is in short supply.

As a nation we have traditionally depended on citizen soldiers, mobilized after the shooting commenced. Technology has changed all of that. The next war, if it comes, will start and move very rapidly. So we are constantly under the gun. But, as a nation, we have not fully developed a pattern for living under the gun—reverting to the "Minute Man" tradition. Among other things our draft rules have been undergoing an evolution. The Reserve Forces Act of 1955 introduced some new features that are expected to have a profound effect on scientific and professional personnel.

Under the Act any man with professional qualifications can enlist, serve on active duty for six months and return to reserve status. Upon reversion to reserve status the man is assigned, first, to the ready reserve; then, contingent on his being in a critical skill and a critical industry, the individual will be assigned to the stand-by reserve. The critical specialty and critical industry categories are so broad that most scientific and engineering men will be screened into the stand-by reserve where they will be subject to call only by authorization of the

Congress and only after the Selective Service System has determined their availability on an individual basis.

It is still too early to evaluate operations under the new Act. It is believed that most draft-eligible young men with professional qualifications will probably choose the six-month-duty means of discharging their military obligations rather than the alternative of being drafted for two years. Industrial concerns are expected to be happy to give such individuals six months leave for military duty to make reasonably certain the man will return to the firm. One unknown in this situation is the impact of the extensive choice of the six-month alternative on the extent the armed services can meet their needs for skilled personnel.

A more fundamental long-range problem is the health of the national education situation as regards the training of future scientists and engineers. Many facets of this problem have been discussed and much has been done. There is an increasing awareness of the problems at every level of government.

Actually the nation's ability to absorb the products of modern technology and its demands for new and greater improvements have outstripped its supply of the types of manpower needed to meet the increased demands. Critical shortages of persons with scientific, technical and other specialized knowledge exist in many fields. The educational system is not turning out enough of these persons. This is due primarily to the fact that young people have been reluctant, or perhaps unmotivated, to enter these fields in sufficient numbers. Then, too, many capable high school graduates are not entering college for one reason or another.

The key to the matter, as far as I am concerned, is in motivation as well as in the thorough preparation of the students. I am, therefore, very happy to see the association take an active part in the encouragement of high school students by their program of incentive and encouragement as indicated by the high school guests here today. These are things which can be done at every level and we have a long way to go before we can be satisfied with out results. It is a real challenge to all of us.

Another situation which confronts us is that of continuing the supply of new knowledge from science which may be used as a base for our technology. New knowledge is essential to future progress and a strong military technology as well as a strong industrial technology must rest on a solid base of fundamental science. The tremendous effort during the last war diverted many scientists from their main mission of basic research and education. As a result, applied research and development has rapidly overtaken the supply of basic knowledge.

Industry support of basic research has been increasing both in our own laboratories and by grants. The government, too, through the Atomic Energy Commission, the military departments, and the National Science Foundation, has undertaken considerable support of basic research. Actually, basic science has its place in the laboratories of applied science as has been pointed out by Dr. DuBridge, President of California Institute of Technology. He stated that not only does basic science provide the fundamental knowledge, but that its performance within applied science facilities, set a high intellectual tone, stimulates the imagination, satisfies curiosity and attracts new scientists to the organization. I would support increased attention to the more fundamental side of our work and would enjoin all of you to do more of it.

With so much emphasis on military-related research and development there are those who question its ultimate value—those who consider it an economic waste. These persons must find their answer, their consolation not only in the preservation of our way of life but also in the peaceful benefits which come from the military work. I have already mentioned some of those things which originated in the military or received their impetus from the necessities of wartime economy—gunpowder, synthetic rubber, radar. There are many others we might discuss—penicillin, aircraft, atomic energy. Now in this new era in which military research and development takes a significant share of the nation's capability, we can expect profound peaceful benefits at an accelerated rate if we will but put our mind to the task.

RAD DEFENSE CONTRACT FOR UNIV. OF CALIFORNIA

Research leading to a nationwide system of radiological defense will be conducted by the University of California under a $591,600 contract recently let by the Federal Civil Defense Administration. Aim of the project, the largest single research agreement ever made by FCDA, is to lay a framework for a national program of defense against radioactive fallout resulting from an enemy nuclear attack.

In announcing the project, Federal Civil Defense Administrator Val Peterson said it would show "how the nation stands now on radiological defense, what we need to do to improve our defense, and the most logical methods to use in making the improvements."

All aspects of radiological defense operations will be investigated, including communications systems, shelter-evacuation, radiological instruments, decontamination, diagnosis and treatment of radiation injuries, and prediction of fallout patterns.

The study will be conducted in the University's Department of Engineering, under the direction of Professor Paul F. Keim.

Earlier this year the FCDA announced plans to expand its fallout defense program by purchasing $3,500,000 worth of radiation detection instruments. These are to be used for the agency's stockpiles and for distribution to the States.

An intensive nationwide training program in radiological defense was begun by FCDA in January. To carry out this program, a Radiological Defense School was established at FCDA headquarters in Battle Creek, Michigan. FCDA has also produced and distributed to State and local civil defense offices a Radioactive Fallout Orientation Kit, contaning teaching materials and instructions.

MAJOR BRADEN TO BOSTON PROCUREMENT SUB-OFFICE

Major Robert C. Braden has been named commanding officer of the Boston procurement sub-office of the Chemical Corps, the Corps has announced. The office is located at Boston Army Base.

Major Braden replaces Major Charles B. Mahanes who will remain temporarily in Boston on a special assignment.

The new commanding officer, who will report early in May, has been Executive Officer of the Administration Division, in the Office of the Chief Chemical Officer in Washington.

Major Braden was born in New York City. He attended New York University, entered the Army in 1941 and served actively in Korea.

"Saturday's no fun anymore"

IT sure used to be, though. Up early—even before the sun hit the window sill. Then tip-toe into Dad's room to wake him up. Sometimes it isn't easy.

He's up now. Careful not to wake Mom. Now you're dressed and in the kitchen where you and Dad whip up a swell breakfast together. Doesn't the coffee smell good? And the bacon frying . . . the hot rolls. A real man's breakfast.

"What'll it be today, Tommy?", Dad asks. "Want to toss a ball around? How about a ride out to Blue Lake? Bet the trout are jumping. You call the shots, son. It's your day."

That's the way it was. The way you thought it would always be. You're not supposed to cry because you're a big guy now. But when you ask "why" no one knows how to answer you. What's cancer anyway? Why did it take Dad away?

For little lads like Tommy—with fun in their hearts and a glove in their hands—cancer deals a cruel blow. Today, because of cancer, there are more than 160,000 children who have to learn to live without a father.

Yet there is hope. Hope for a final, certain cure for cancer. The men and women in our research laboratories are working night and day toward this end. But they need your help. Badly.

There has never been enough money to carry on all the research that needs to be done. Can you afford to remain indifferent to this enemy that strikes 1 out of every 4 Americans?

We need your support. Give generously.

AMERICAN CANCER SOCIETY

GENTLEMEN: I want to help conquer Cancer.

☐ Please send me free information about Cancer.

☐ Enclosed is my contribution of $_____ to the Cancer Crusade.

NAME_____

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CITY_____ZONE_____STATE_____

MAIL TO: Cancer, c/o your town's Postmaster.

This is the fifth in a series of articles on the origin, development, and product fields of the sustaining member companies of the Armed Forces Chemical Association which reflect the vital role of chemical science and industry in the National Defense. The next article in this series is scheduled for the September-October issue.—Ed.

THE DOW STORY

By CARL A. GERSTACKER
Vice President and Treasurer
The Dow Chemical Company

Founder Herbert Henry Dow "started on a shoestring and built for the future when the American chemical industry was young . . . grappled with great foreign combines—and won . . . built for peace and progress, but along with others in the industry, he laid the foundations . . . that helped America win its two great wars."

IN THE WORLD of Herbert Henry Dow, brine was the stuff that dreams are made of. Fifty-nine years ago he organized The Dow Chemical Company, and his dreams began to come true.

Deep under the flatlands of Midland, Michigan, lies an ancient ocean. In its salts, rich in magnesium, chlorine, calcium, sodium and bromine, Herbert Dow found the raw materials of creative chemistry.

He started on a shoestring and built for the future when the American chemical industry was young. He grappled with great foreign combines—and won. He built for peace and progress, but along with others in the industry, he laid foundations of skill and foresight that helped America win its two greatest wars.

FOSTER DRILL HOUSE
This old Drill House gave Dr. Herbert H. Dow his first source of brine from the ancient ocean under the Midland, Mich. area.

We like to tell people about Herbert Dow because his story is part and parcel of the growth of America's chemical industry. Potassium bromide and bleach were his only products at the turn of the century. Today the company that carries on his name—and spirit—has more than 600 products. And there seems to be a lot of unexplored acreage in the world's chemical frontier.

Herbert Dow, brimming with ideas and painfully short of cash, came to Midland in 1890. It was a lumbering town with 14 saloons and a doubtful future. Midland's brine wells were yielding salt and bromine, but the extraction process, which utilized cheap fuel was doomed. The great pine and hardwood forests had yielded to the woodman's axe.

Dow, as a student chemist at Case School of Applied Science, had worked out a process for electrolytic extraction of bromine from the brine. A family friend put up his capital— a few thousand dollars—and he set up shop in a rented barn. For electricity, he hooked up a homemade rope drive from the steam engine of a flour mill to a 15-volt generator. To obtain raw material, he reactivated an idle well.

In seven years of trial, error and frequent frustration Dow acquired the knowledge that led to the founding of The Dow Chemical Company in 1897. The electrolytic cells of his tiny Midland Chemical Company leaked and cavorted. The barrels in which he packed his product shrank. Cash was hard to come by. Dow sold his first two barrels of potassium bromide at half the

market price because they contained impurities. At that, he and former Grace A. Ball, his bride, spent two days picking out the foreign matter.

But Dow's idea, chemical production through continuous process, was basic. The Midland Chemical Company began to make money. Herbert Dow became the first man in the world to obtain bromine in commercial quantities by electrolysis.

Chlorine Extraction Plant Explodes

IN 1895, HE BUILT an electrolytic plant for extracting chlorine, which he noted offered "an enormously greater field." An hour after it began operation, the chlorine plant exploded.

"A meeting of the board of directors was called and it was decided they did not care to do any more expanding," Dow wrote in his notebook. He was 29 years old.

But Herbert Dow wanted to expand—and to learn. Hundreds of miles away, near Navarre, Ohio, he entered six months of seclusion in a wooden laboratory behind an eight foot fence. "I'm making embalming fluid," he told the curious. In reality, he was experimenting with the use of chlorine in bleach.

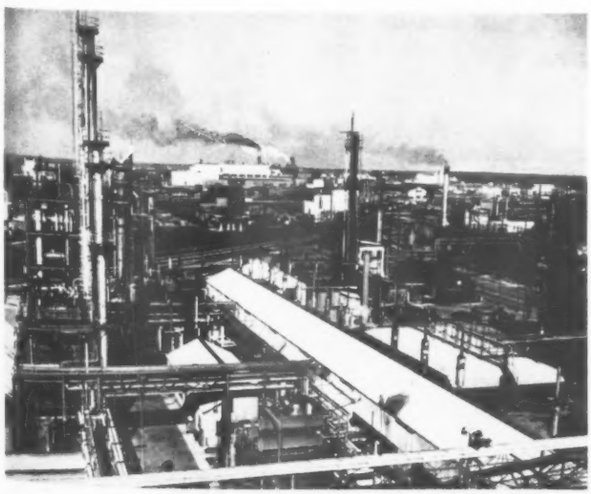
Back in Midland, he leased land from his Midland Chemical Company, built a pilot bleach and chlorine plant, and sought capital.

Fifty-seven investors pledged a total of $200,000, and on May 18, 1897, the present Dow Chemical Company was born. Its first President was Albert E. Convers, a Cleveland tack manufacturer. Herbert Dow was boss of the works.

Dow had planned well. Side by side, The Dow Chemical Company and the Midland Chemical Company utilized the same brine. The "waste" from the bromine extraction became the raw material for making bleach.

From early losses of $163 a day, The Dow Chemical Company went into the black as production skills were learned. The Midland Chemical Company, which had been content to throw away its waste products, later was purchased by Dow for $300,000.

Leland I. Doan, who in 1949 succeeded Herbert Dow's son as president of The Dow Chemical Company, makes this comment: "With some duplication of stockholders and directors, an eventual merger was probably inevitable. But I think it is significant that when the merger came in 1900, it was the more enterprising Dow Chemical that absorbed the original corporation rather than the other way around."



MIDLAND PLANT VIEW
From a single building, Dow's Midland plant has expanded over 1,700 acres.

Herbert Dow and his team wanted to grow.

By 1902, the chlorine and bleach plant had a total capacity of 72 tons a day. The price of bleaching powder had dropped from $3.50 to $1.68 per hundredweight. And abroad there were mutterings about the American upstart.

British bleach manufacturers, who for years had counted on the American market as gravy, were getting hurt. To fight back, they organized the United Alkali Company, capitalized at millions of pounds. Ignoring production costs, the English syndicate dropped its price in 1903 to $1.04 per hundredweight in what was intended to be a death blow to the American producers.

And the syndicate promised a coup de grace: In 1904, it said, the price would be 88½ cents, about half the price at which The Dow Chemical Company had organized to do business.

Founder Fights English Syndicate

DOW'S DANDER was up. He was fighting for the future of his company, later to become the world's major chlorine producer, and of the American chemical industry. He committed most of his output for the next year at 86 cents.

Abruptly the syndicate gave up. It set its price at $1.25 and other American producers, who had held off on commitments, followed suit.

Dow lost $90,000 in income—something less than half of his company's total capital when it was organized six years earlier.

To recoup, Dow expanded his product line, although sometime the uses were hard to foresee. An order from Australia turned up a market for mining salts—and resulted in the present Dow trademark. A workman charged with painting the salt packages with the word "Dow" inside a rough rectangle developed a freehand fancy for a diamond instead. Dow adopted his design.

A new process to manufacture chloroform caught Herbert Dow's eye, but met lukewarm response from some of his directors. It involved field work in organic chemistry, stronghold of German science. Dow, undaunted, formed a second and new Midland Chemical Company in 1902 to prove that the process worked—which it did. The company was absorbed by the parent corporation in 1918.

The process involved making sulfur chloride, reacting it with carbon bisulphide, producing carbon tetrachloride, which then was treated with iron in the presence of water to produce chloroform. It was a first for America in commercial production of a synthetic organic chemical. And as Dow was to prove again and again, the venture opened new doors to progress.

Carbon tetrachloride, for example, developed into an important primary product. Shortly before World War I, it began to find wide use as a fire extinguisher, cleaning fluid and industrial solvent.

And down in Detroit, automobile manufacturers were installing pneumatic tires on their products. Flats were the hazard of the road, and a sponge rubber sausage to replace the inner tube became much in demand. Sulfur chloride was a key chemical in the sausage manufacture.

Later, Dow was to help the motoring public in dozens of ways—calcium chloride to lay dust in summer and melt snow and ice in winter, plastic fibers for interior

fabrics, light and durable magnesium for structural and working parts of the car, anti-knock and anti-freeze compounds, to name a few.

While Dow was still breathing hard from the battle of the bleach, it took on another—and more formidable—foreign challenger. The company had begun to export some of its bromide and the mighty German bromine cartel rose in wrath.

Meets Threat of German Cartel

HERBERT Dow, enroute with his family to California in 1906, received a summons to New York, where a representative of the German Bromine Convention was waiting with fire in his eye.

Dow agreed to wait over a day in St. Louis if the German, one Herr Jacobson, had important business. Jacobson came—with an ultimatum to Dow to stop foreign shipments immediately unless he wanted the Germans to ship two pounds of bromides into the United States for every pound he shipped abroad.

"That," said Dow, "is up to you." Then he took the evening train for California. Dow said later he thought the German was "bluffing." A protective tariff of two cents a pound helped save his company in the three-year battle that followed.

Without regard to price, Dow lined up all the advance orders he could. While the combine undercut Dow at home, he undercut their prices in Europe. The price at one time was 10 cents a pound. For the first and only time in its history, The Dow Chemical Company paid no dividends. Herbert Dow drove a one-horse buggy badly in need of paint. And by hook and crook, he beat the Germans at their own game.

Dow's fight was not wholly popular with his stockholders. Nor was his decision to spend hard-won profits for research.

Even his best friends advised him to think in terms of dividends in the immediate future. One stockholder conceded his gift of discovery, but added: "He is not a safe man to expend the money of poor widows and orphans."

In 1909, Dow was following the research policy of 1956. He saw the chemical laboratory as a place to create and develop products useful to man. One idea was making synthetic rubber. It proved to be 30 years too soon, but it gave Dow a background for a major contribution to World War II. Another idea was "cracking" of petroleum to make hydrocarbons. Dow had lots of bromine and chlorine on tap. If they could be combined with hydrocarbons, a vast new manufacturing field could develop. And it did—eventually.

Of more immediate value was a Dow decision to install new electrolytic cells, which would permit far more complete utilization of the Midland brine. Besides chlorine and bromine, three other chemical workhorses were ready for harness: the salts of sodium, magnesium and calcium.

The new "works" gave Dow a vast source of chlorine, and he thought he knew how to use it. "By this time, Herbert Dow could see that carbon tetrachloride and chloroform and lead arsenate and other things using chlorine were going to be a pretty good gamble," explained Dr. E. O. Barstow, one of Dow's associates who was to become a Dow vice-president. The lead arsenate, for instance, was the forerunner of a long line of agricultural chemicals which have added countless tons to American food production.

New Methods Become Military Asset

AND AS WORLD WAR I flared in Europe, both the new cells and Dow's knowledge of chemical synthesis became vital military assets.

Germany had built up tremendous skills in making dozens of organic chemicals. Now its exports stopped. Dyestuffs all but vanished in America. Even aspirin was hard to come by. From Washington, the call went out for miracles—by the ton.

In the chemical industry, men with ideas went to work. In 18 months, Dow had synthetic indigo on the production line, using a tonnage process that was to smash German invincibility in dye manufacture.

Dow turned out 30 million pounds of caustic soda for the war, although it was a newcomer to the caustic field. It turned out an equal amount of chlorine. Both products are basic "building blocks" for a variety of war materials.

Dow scientists were asked by the Government to make synthetic phenol, basic in the manufacture of such disruptive explosives as picric acid and TNT. Their effort yielded 23,500,000 pounds for the war effort. And the biggest plant in the United States—with capacity of 3,000,000 pounds a month—was just starting operations at Midland when the armistice came.

No one at Dow relished the assignment of making mustard gas. But the company turned out as much as 10,000 pounds a day. After the war, the remaining supply was buried at sea.

Carbon tetrachloride was in heavy demand both for primary war and civilian uses and as an intermediate for making war materials. For instance, a great deal of the 10,000 pounds Dow produced went into the synthesis of chloroform for military and civilian medical use and as an organic solvent for industry.

Dow made aspirin—as much as 125,000 pounds a month. It developed and produced acetic anhydride, an organic solvent for waterproofing and strengthening airplane fabrics. It produced quantities of bromine for such uses as medical bromides, photographic film for aerial reconnaissance, and tear gas. (Seventeen extra brine wells had to be drilled and an extra power plant added for a branch of the Army's Edgewood Arsenal, built and operated by Dow for the Chemical Warfare Service). Dow produced huge quantities of chlorbenzol for explosive makers, of Epsom salts and other magnesium products, and of insecticides.

After the war, Herbert Dow wrote to a stockholder that the market price of Dow stock had declined more than 50 per cent from the time the United States became an ally until the armistice. The net profit amounted to less than one per cent a year. Dow had a citation from the War Department for patriotic service—and an uncertain future.

Some of the wartime products proved eventually to be important sales items. But several of Dow's biggest plants had to be scrapped, including that for making phenol which had just started production. Phenol and caustic soda, economic barometer of the chemical industry, were gluts on the market.

More Research, the Key to Survival

HERBERT Dow knew the way to survive—expand research even more and modernize. It was the merger era in American business, but Dow decided to go it alone. A protective tariff helped the hard hit chemical industry in its postwar fight to take hold and grow.

From the laboratory emerged better indigo, salicylates, aromatics and better ways to make them. New demand developed for phenol in the infant plastics industry. This time the company decided to make phenol with a new process, using chlorobenzene. Not only did the process work, it produced important by-products which became the basis for such lines as fungicides and heat transfer agents. A logical next step was the manufacture of aniline from chlorobenzene. Fascinating new chemical chains appeared on laboratory blackboards. Sales climbed. Again research had proved its worth.

More than 60,000 shares of new stock were issued by Dow between 1923 and 1929, creating hundreds of new jobs and a variety of new products. By the end of the 1920s, Dow was a $23,000,000 corporation with sales reaching a high of $18,000,000.

Honors came to Herbert Dow who had seen many of his dreams come true. The Case School, his alma mater, and the University of Michigan awarded him honorary doctorates. In 1930, he received the Perkin Medal for Chemical Achievement, highest award in American industrial chemistry. He died on October 15 of that year.

"I imagine they're wondering around here what will happen when I'm gone," said Herbert Dow before his death. "Well, they've got pletnty of work lined up for them."

Willard H. Dow, who was born in the same year as the company, became president and proved his father's words. He met America's great depression with expansion and ideas. Willard Dow, a University of Michigan engineering graduate, shared his father's optimism about the industrial future.

"While the rest of the world was in a very great depression our people continued to be stimulated by the thought that there were new worlds to conquer," he told a friend.

That attitude earned Midland the title of "the town that never knew there was a depression." The attitude brought new minds to town, and new developments in Dow history.

One development was the successful extraction of bromine from sea water in 1931 at a pilot plant near Wilmington, North Carolina. (There is one pound of the element in about 15,000 pounds of raw sea water.) Commercial production began a year later on the same site when the Ethyl-Dow Chemical Company was formed to make ethylene dibromide, used in Ethyl gasoline. A similar and larger operation was later established at Freeport, Texas, on the Gulf.

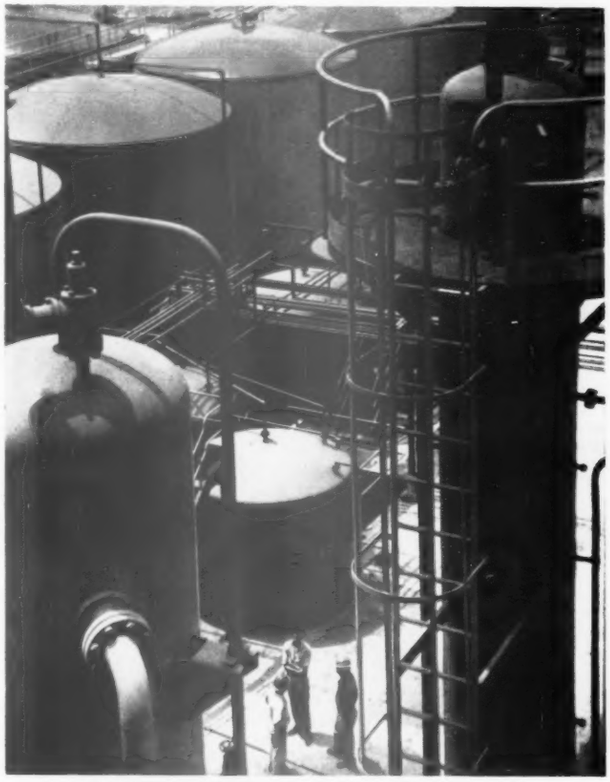
Research and technical men developed three primary plastic materials—saran, Ethocel and Styron, used today in hundreds of household and industrial applications.

Major Materials For Synthetic Rubber

In the case of Styron, this research was to help keep America and its fighting men on wheels during World War II. Styrene, the monomer on which Styron is based, and butadienne were the two major materials used in making GR-S (synthetic) rubber. Dow, when the crisis came, was the only commercial producer of both.

Dowell Incorporated, a wholly owned subsidiary designed to carry Dow's process for acidizing oil wells to the petroleum industry, was formed in 1932. With continuing research Dowell services have greatly increased America's petroleum output.

Two years later, Jones Chemical Company, a Louisiana iodine plant jointly developed by Dow and Dr. C. W. Jones, became Io-Dow Chemical Company. It later was incorporated in Dow's Western Division, formed in 1938 through the merger of the Great Western Electro-Chemical Company with Dow. The Division, with a plant in Pittsburgh, California and general offices in San Francisco, produces large quantities of liquid chlorine for pulp bleaching and water purification, caustic soda for soaps and oil refining, ammonia for refrigeration and other heavy chemicals for a world market.



CHLORINATION PLANT AT PITTSBURG, CALIF.
Giant vessels dwarf employees at the chlorination plant in Dow's Western Division plant at Pittsburg, Calif.

In 1935, Dow obtained a controlling interest in the Cleveland Cliffs Chemical Company at Marquette, Michigan, and transformed it into Cliffs-Dow Chemical Company, a subsidiary making products through the distillation of hardwood.

Dow opened a magnesium foundry and fabrication plant in Bay City in 1936, to be followed in three years by the boldest project of all: Extraction of magnesium from the sea.

The Texas Division was established at Freeport for this purpose and later to utilize Texas petroleum resources in the manufacture of organic chemicals.

An army of construction workers displaced Angora goats grazing on Texas lowlands off the Gulf. Architect Alden B. Dow, another son of the founder, designed a new city, nearby Lake Jackson with a current population of 7,400. And, on January 21, 1941, Dow poured the first ingot of magnesium to be taken from the sea. It developed that a demanding customer—war—would soon swallow the plant's capacity and more.

For most of the letters of the alphabet Dow had chemicals—or made them—that went to war and helped to win it. The list runs from aniline, key to khaki and other dyes, to xanthates, flotation agents in the mining of critical copper, lead, and nickel ores.

For some products, production increased 100 to 1,000 per cent. Magnesium, which had shown glimmerings of greatness in World War I, is a case in point.

As early as 1896, Herbert Dow had set his sights on making magnesium hydrate. Twenty years were to pass before his first limited success at making magnesium metal.

Magnesium from Midland Brine

ON A HOT DAY of July in 1916, a group of Dow scientists hovered anxiously over a box of welded boiler plate, lined with slabs of soapstone. They were attempting to make metal from electrolysis of magnesium chloride, a product of the Midland brine. The men stayed

MAGNESIUM METAL FROM SEA WATER

These Dorr settling tanks containing precipitated magnesium hydroxide are part of the facilities for producing magnesium metal from sea water at Dow's Texas Division.

up all night, unconcernedly sniffing chlorine, and their loving care produced a one-pound cake of metallic magnesium.

By winter, the group decided they could produce the metal in quantity. It was Autumn in 1917 when the plant was ready. Within 48 hours, it was shut down as a failure. They built another plant. It was destroyed by fire.

"But they had courage and they had leadership," Willard Dow noted later. In the midst of a postwar depression, Dow built another plant and began again to make the metal.

Over the next decade, the seven other companies that entered the field during World War I abandoned their production efforts. Dow, with an open field but few markets, incurred a loss on the sale of magnesium for all but four of the years between 1918 and 1939. With a few other companies, Dow carried on research on uses of the metal and its alloys and to develop fabricating techniques in the face of general industry apathy. At the same time, Dow had to learn economical production to sell magnesium on its merit.

Dowmetal, alloys of magnesium suitable for structural purposes, made their appearance in the 1920s in the production of pistons for automobile engines. Their uses were to grow.

In June of 1939 the price of magnesium was reduced to 27 cents a pound. (The metal had sold for as high as $5 a pound during World War I.) Dow doubled its capacity, to 12,000,000 pounds a year, although sales still tagged behind production. Within a year, the company more than redoubled capacity with the first production of magnesium from sea water at Freeport.

Nearly 11 months before Pearl Harbor, the Freeport plant went into production, a source of comfort when later the Government assessed the wartime need.

The Office of Production Management called in June, 1942, for an increase to 400 million pounds, later to 600 million. Dow built magnesium facilities for the Government at Freeport and Velasco, Texas and Ludington and Marysville, Michigan.

In 1942, the critical year in the gaining of air supremacy over Europe, Dow-operated plants produced 84.2 per cent of the nation's magnesium output. The peak month of national magnesium production was January, 1944. Dow process plants accounted for 54.6 per cent of the 42 million pounds produced that month.

Magnesium went to war in aircraft wheels, engines, and frames, in a variety of ordnance equipment (bazooka barrels, for instance) in incendiary bombs, flares and tracer powder, and in a variety of alloys with aluminum.

New Military Applications of Chemistry

IN OTHER WAYS, too, the chemical industry was revolutionizing militay science. Here is a sampling of Dow products and what they did:

Plastics—Saran monofilaments were woven into insect screening that defied rust and rot in the tropics. A form of Styron was molded into the first successful radar housings for aircraft, a development that was a key to smashing the "wolf pack" menace in the Atlantic. A form of Ethocel became a part of the proximity shell that helped win the Battle of the Bulge. There were Ethocel eye shields, map protectors, gun muzzle covers. Stripcoat and saran film protected machine guns and precision parts and instruments from corrosion.

General Chemicals—Uses of carbon tetrachloride ranged from making Freon for aerosol bombs to an industrial solvent, uses of caustic soda from processing vegetable oils to making soap and explosives. Phenolic compounds became starting materials in the making of agricultural chemicals, photographic chemicals, plastics, of germicides, fungicides and preservatives that lengthened the life of tents, camouflage paints, pontoons, hawsers, paper. Dow chemicals helped to dye the soldier's uniform, to tan his shoes, to make his shaving cream, to shroud him in smoke screens, to keep his powder dry, his weapon lubricated, and his drinking water pure.

Lights burned late in Dow plants across the nation. "There was a lot of rush and a lot of hush hush," said an executive. "Everybody was up to his neck. But we were well organized."

Women, strangers to chemical production, appeared in the laboratories and even some of the production plants. Dry cleaners had to be told that their solvents were on government allocation. Hundreds of Dow men joined the fighting forces—and left holes in the production ranks.

"We'd have a technically trained man who knew his job from A to Z," said a production supervisor. "He'd go into the military. Then we'd get a greenhorn. He'd just be getting trained—and zingo, we'd start all over again." By the end of 1944, more than 4,500 employees were on service rolls.

Around a fenced, secret chemical warfare project, armed guards walked on patrol. Only deer from the Midland woods got close enough to peek. One guard was near breakdown when he came off patrol. "Biggest buck I've ever seen," he said. "And I couldn't shoot it."

Allied military aircraft flew higher because Dow and Corning Glass Works joined forces in 1943 for commercial production in the new field of silicone chemistry. The Dow Corning Corporation plant at Midland concentrated during the war on production of an insulating compound to seal airplane ignition systems at high alti-

tudes. Its mounting contributions since the war have ranged from making shoe leather water resistant to diverse specialized uses in industry and national defense —resins, oils, greases, rubbers and insulating compounds. Silicone insulation is used on the atomic submarine Nautilus.

Postwar Conversion Proves Costly

WHEN PEACE TIME came in 1945, great new chemical markets awaited exploration. But conversion to peacetime manufacture, Dow economists estimate, cost the company $20,000,000.

Research ideas came out of wartime cubbyholes. Dr. Willard Dow, who was to die in an airplane crash in 1949, called for work, imagination and expansion.

Plastics is a case in point:

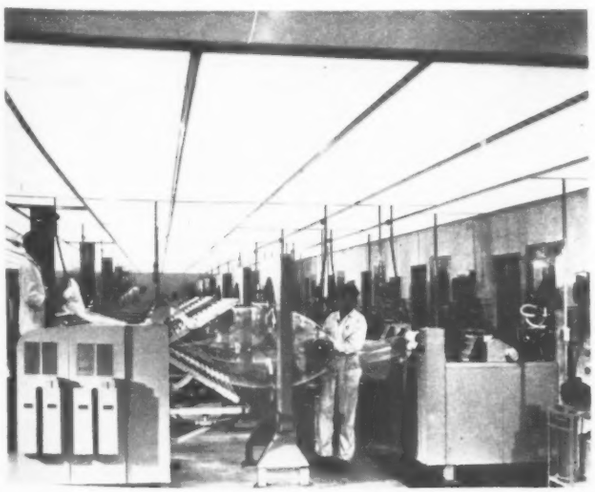
Dow, the only pre-war producer of styrene, had revealed much of its know-how to industry at large during the war to bolster manufacture of synthetic rubber. When the conflict ended, it had two competitors, using all or part of Dow's own styrene process.

Dow still counted on a growing market. It had formed Dow Chemical of Canada, Limited, in Sarnia, Ont., in 1942 to operate a styrene plant for the Canadian Government. Dow's major postwar additions at Sarnia included new production facilities for styrene and polystyrene. Dow also bought from the War Assets Administration the big styrene plant it had built and operated for the government at Velasco, Texas.

And as America became plastics conscious, polystyrene compounds became a growth leader of the plastics industry.

For instance, Styrofoam (expanded polystyrene) had been used with tarpaulin wrapping during the war to float equipment across bodies of water. Now the plastic foam began to find wide use as an insulator in cold storage and general construction and as a packaging, ornamental and decorative material.

From wartime saran film, Dow developed Saran Wrap,* clinging transparent film widely used in industrial and home packaging. At Odenton, Maryland, Dow and the National Plastics Products Company formed the Saran Yarns Company to produce fine plastic fibers for carpets, draperies and other fabrics.



SARAN WRAP

Dow employees making Saran Wrap at the Midland plant form a traped air bubble in a small tube of saran. The film thus becomes stretched until its walls are about one-sixth the thickness of a human hair.

*Trade Mark.

HYDROCARBON SECTION AT FREEPORT, TEXAS

Tall minarets soar from the light hydrocarbon section of Dow's Texas Division at Freeport.

Dow's family of plastics appeared as wall, tile, synthetic latexes for paper and paints, television masks, dishes and kitchenware, pipes, toys, flashlight cases, vacuum cleaner parts—even doll hair.

Today plastics account for about one-third of all Dow sales.

The postwar magnesium story began with less of a surge. Sales fell to the 1939 rate, and Dow became again the lone domestic producer.

The company continued production at Freeport, leased the government magnesium plant it built at Velasco, and went all out to spread its faith.

Steady Increase In Magnesium Use

FROM 1947, USES of magnesium increased steadily—with extra impetus provided by war in Korea. Groups outside Dow began research and development in the technology and application of magnesium. And two years ago, Dow served notice that magnesium had come of age:

The company spent $40,000,000 to take over a huge government mill at Madison, Illinois, and equip it as the world's first facility for mass production of magnesium wrought products.

Today magnesium appears in such varied forms as corrosion-retarding anodes, truck and trailer bodies, portable tools, a variety of aircraft and automobile parts, tooling plate, photoengraving plates, dockboards and handtrucks—even luggage.

And the raw material is not likely to be in short supply. There are an estimated 12 billion pounds of magnesium in each cubic mile of sea water that sluices into the Texas plants from the Gulf.

(Continued on page 43)

Bronze medal, actual size.

A. F. C. A. AWARDS TO OUTSTANDING ROTC STUDENTS

This year the Armed Forces Chemical Association revised and extended its program, inaugurated in 1948, for special recognition by the Association of outstanding ROTC cadets at selected colleges and unversities who are majoring in chemistry, chemical engineering or allied sciences.

The A.F.C.A. award consists of a bronze medal of military type, in a handsome plastic display case, with blue and gold striped ribbon, the colors of the Army Chemical Corps. The medal is engraved with the name of the winner who is also given an embossed certificate of the award, suitable for framing.

Originally this award program was confined to Chemical Corps units of the ROTC. Later, the program was enlarged to include a fixed number of Navy and Air Force ROTC organizations. This year with the trend in the Army ROTC being toward general rather than specialized or branch training, the program reflects extensive re-study and overhauling of the award procedures recommended by the committee headed by Association Vice-President, Oliver F. Johnson and approved by the Executive Committee. Moreover, a definite list of twenty-five participating colleges and universities has been established. Selections for this list were based on a number of factors including: previous participation of the colleges or universities in the program; indicated interest in these awards by the various authorities concerned, and convenient location of the institution with respect to a chapter of the Association, so as to facilitate participation by A.F.C.A. chapters. At some of these institutions the ROTC organization includes all three of the Armed Forces while at others only one component (principally Army) is represented. However, the award winners were selected without distinction as to their service—whether Army, Navy or Air Force.

This year's group includes fifteen Army, five Navy and four Air Force winners. (One of the listed universities did not participate this year).

Following are brief biographies of these outstanding cadets, a considerable number of whom were graduated this June.

Blank of A.F.C.A. Award Certificate 8½x11 inches. The gold seal with blue and yellow ribbon is affixed as shown when certificate is prepared for presentation.

THE ARMED FORCES CHEMICAL ASSOCIATION
OF THE UNITED STATES OF AMERICA

HAS AWARDED TO

THE ASSOCIATION MEDAL AS AN OUTSTANDING R.O.T.C. STUDENT
WHO HAS EXCELLED IN THE FIELD OF CHEMISTRY OR AN ALLIED SCIENCE
AT . DURING THE YEAR

GIVEN AT WASHINGTON, D. C.

President

LAWRENCE BADASH

LAWRENCE BADASH is an NROTC student at Rensselaer Polytechnic Institute, Troy, New York, where he holds the cadet rank of Midshipman Company Commander. Cadet Badash is specializing in physics and has been very active in the Reserve program. He has been a member of the NROTC Rifle Team, the NROTC Student Advisory Council, and the NROTC Drill Squad. He has also participated in Freshman and Varsity LaCrosse and is a member of Phi Sigma Delta. Cadet Badash was born on May 8, 1934, in Brooklyn, New York.

JOHN RANDALL EAGLE

JOHN RANDALL EAGLE, a 1956 graduate of the University of Delaware, received the A.F.C.A. medal with cluster this year, since he won the Award for the second time. He had previously received the Smith Award as Outstanding Sophomore and Junior military student and as a sophomore was named Outstanding Sophomore military student by the Scabbard and Blade Society. Mr. Eagle, who was born in Philadelphia, Pennsylvania, on July 4, 1934, specialized in chemical engineering. He held the rank of Cadet Major in his ROTC unit and served as President and Vice-President of Delaware Rifles, Treasurer of Scabbard and Blade, Secretary of Tau Beta Pi, Assistant Athletic Chairman for Theta Chi fraternity and editor of the fraternity paper. He also participated in All Intra-Murals, and Freshman and Varsity Baseball. He was a member of the American Institute of Chemical Engineers, student chapter. A Monsanto scholarship was awarded to Mr. Eagle for his senior year.

DENNIS JON BREVIK

DENNIS JON BREVIK, a graduate this year in chemical engineering from the University of Detroit, held a full-time job during most of his college career. Yet he was able to achieve outstanding scholastic honors and attain one of the top positions in his Army ROTC unit, Cadet Major and Battalion Executive Officer. Cadet Brevik was born in Royal Oak, Michigan, on January 17, 1934. On the basis of his high school record, he received a scholarship from the Blow College Fund of Royal Oak, but earned most of his college expenses through his night job and the cooperative program (alternate three-month periods of school and work). He found time, however, to serve as editor of the American Institute of Chemical Engineers newspaper and to hold membership in the Society of American Military Engineers, Tau Beta Pi, and the National Honor Society. Mr. Brevik was selected for commission in the Army Chemical Corps.

OLIVER F. JOHNSON

Heading A.F.C.A.'s Awards Committee which recently revised and put into operation more definite procedures for the R.O.T.C. awards program, is Mr. Oliver F. Johnson, Vice-President of the Association.

Mr. Johnson, electrical engineer, a resident of Greater Washington, is executive vice-president of Adache Engineers, a consulting architect-engineering firm of Cleveland, Ohio. He is also manager of the Dualex Division of Bell & Gossett Co., Morton Grove, Illinois, in charge of the Company's work in electronic communications.

Despite his extensive professional and business interests Mr. Johnson has managed to devote a good deal of time and effort to Association affairs, particularly the R.O.T.C. awards program.

A native of Columbia, Missouri, Mr. Johnson studied eletcrical engineering at the University of Missouri. During World War II he served the United States Government in establishing the rationing system nationwide and later as Executive Officer of the Office of Price Administration. Mr. Johnson is a brother of Lieutenant General Leon Johnson, of the Air Force who recently was appointed United States Representative to NATO.

PARTICIPATING COLLEGES AND UNIVERSITIES

California, Univ. of
Carnegie, Inst. of Technology
Colorado, Univ. of
Columbia Univ.
Cornell Univ.
Delaware, Univ. of
Detroit, Univ. of
Georgia Inst. of Technology
Idaho State College
Illinois, Univ. of
Massachusetts Inst. of Technology
Michigan, Univ. of
Nebraska, Univ. of
Ohio State Univ.
Ohio, Univ. of
Oklahoma, Univ. of
Purdue Univ.
Rensselaer Polytechnic Inst.
Rice Inst.
St. Peter's College
Texas, Agri. & Mech. College of
Vanderbilt Univ.
Wake Forest College
Wisconsin, Univ. of

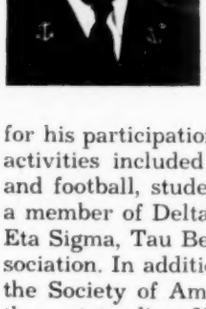
JOHN DICKSON BALDESCHWIELER

JOHN DICKSON BALDESCHWIELER, ROTC cadet at Cornell University, was born November 14, 1933, in Elizabeth, New Jersey. He is a chemical engineering student whose scholastic achievements have enabled him to make the Dean's List for four consecutive years and to win two scholarships. While at Cornell he participated in Track, Cross Country and Basketball, as well as the Men's Glee Club. Cadet Baldeschwieler, who was named a Distinguished Military Student, held the cadet rank of Lieutenant Colonel. He is a member of the American Institute of Chemical Engineers and the American Ordnance Association.

FREDERICK WILLIAM CAMP

FREDERICK WILLIAM CAMP, graduated this June, was a member of the NROTC Unit at Columbia University. He maintained a straight "A" record in chemical engineering during his senior year. Born in Washington, D.C., on July 1, 1934, Cadet Camp entered Columbia in 1952 under one of its National Scholarships which are awarded to 30 outstanding students each year. During his junior year he received an RCA Scholarship. Mr. Camp's college activities included Glee Club, Varsity Fencing Squad, and Sigma Chi Fraternity, of which he was President during his junior year. He held the cadet rank of Midshipman Lieutenant.

ROBERT A. THYGESON



ROBERT A. THYGESON, 1956 graduate in chemical engineering at the University of Wisconsin, was a member of the Naval ROTC unit. During his senior year he was appointed Battalion Commander of the Unit, which is the highest rank that a midshipman can obtain. Mr. Thygeson was born in Racine, Wisconsin, where he graduated first in his high school class of 300 and won the VFW Good Citizenship Award for his participation in high school activities. His college activities included participation in intramural bowling and football, student elections and choral groups. He is a member of Delta Tau Delta, social fraternity, and Phi Eta Sigma, Tau Beta Pi, and the Lutheran Student Association. In addition to the A.F.C.A. award, he received the Society of American Military Engineers Award for the outstanding NROTC engineering student and the Navy League Award for the highest Naval Science scholastic standing.

ROBERT BENTON CAMPBELL

ROBERT BENTON CAMPBELL, a high-standing chemical engineering graduate this year at Carnegie Institute of Technology, received the Koppers Company scholarship for three years. Mr. Campbell held the rank of First Lieutenant in the Signal Corps ROTC unit, was outstanding Cadet of the Pershing Rifles Company in 1954-55, and was a member of Scabbard and Blade, honorary society. He was Drum Major of the Carnegie Tech Kiltie Band, Pledgemaster of Pershing Rifles, Representative on the Men's Dormitory Council, a member of the Student Chapter of the American Institute of Chemical Engineers, and also a participant in various intramural sports.

CHARLES STEPHEN CANTER

CHARLES STEPHEN CANTER, in this year's graduating class for a bachelor's degree in chemical engineering at the Rice Institute, Houston, Texas, was a member of the Army ROTC unit, and one of the outstanding students of military science there. He maintained an excellent academic record, and was the recipient of a Thomas Aubrey Dickson and Pauline Martin Dickson scholarship. Mr. Canter, who has held the grade of Master Sergeant, was Secretary of the college chapter of the American Institute of Chemical Engineers, and a member of Phi Lambda Upsilon, Sigma Tau, Tau Beta Pi and Chevron. He was born on July 21, 1934, at Tulsa, Oklahoma. He resides at 2357 Camden Drive, Apt. 6, Houston, Texas.

CARROLL MARX TOUPS

CARROLL MARX TOUPS of Vanderbilt University, who won the A.F.C.A. award last year as a junior, received the medal with oak leaf cluster this year as a second-time winner. Enrolled in the Army ROTC, he was a letter man on the Vanderbilt football team and was awarded an athletic grant-in-aid. Mr. Toups, who was born on November 11, 1934, at Houma, Louisiana, served as President of several organizations, including the Honor Council, Omicron Delta Kappa, Scabbard and Blade, Newman Club, and the Vanderbilt chapter of American Institute of Chemical Engineers. He was also a member of the Engineering Council, V-Club, Scampers Organization, Student Christian Association, Publications Board, and Phi Delta Theta, social fraternity. In spite of all his extra-curricular activities, Mr. Toups maintained a high scholastic average in his field of chemical engineering, and also attained a high rating both in his company and at the 1955 GMS summer camp at Fort Benning, Georgia. He held the cadet rank of Major in the ROTC.

CHARLES KENNETH CORDES

Charles Kenneth Cordes, Army ROTC cadet and pre-medical student, graduated from Saint Peter's College in Jersey City this year, was born in Brooklyn, New York, on September 11, 1934. He stood in the top group of senior pre-medical students at his college and his grades in chemistry placed him in the upper five per cent of all students taking that subject. In addition to his scholastic achievements, Mr. Cordes had an outstanding record in ROTC. He held the cadet rank of Lieutenant. Mr. Cordes was a member of the History Club at St. Peter's and was on the Dean's List during his junior and senior years. He was recently awarded a New York State scholarship for medical students.

TOMMY LAYTON GOSSAGE

Tommy Layton Gossage, Air Force ROTC cadet at Georgia Institute of Technology, Atlanta, who was graduated this year, was one of his school's outstanding athletes as well as one of its top chemical engineering students. Awarded a football scholarship on the basis of his high school performance, he played guard and tackle for Georgia Tech and helped the team to achieve victory in the 1955 Cotton Bowl and the 1954 and 1956 Sugar Bowl games. Mr. Gossage, who was born in Nashville, Tennessee, on May 7, 1934, was a Distinguished Military Student and held the cadet rank of Colonel. He was Vice-President of the T-Club (Letterman's Club), and is a member of the Scabbard and Blade, Arnold Air Society, Tau Beta Pi and Phi Kappa Phi honorary societies. He is listed in *Who's Who in American Colleges and Universities*. Mr. Gossage plans to work towards a Master's Degree in chemical engineering before beginning his tour of duty in the Air Force.

ROBERT J. HULL

Robert J. Hull, ROTC cadet at Massachusetts Institute of Technology, is specializing in physics. He has maintained a high scholastic average and is the top military student among the 32 cadets in the Chemical Corps Unit at M.I.T. Cadet Hull, who was born in Salem, Massachusetts, on July 6, 1936, holds the rank of 2nd Lieutenant, the highest cadet rank obtainable by a junior. His college activities have included membership in Scabbard and Blade and the 5:15 Club, and participation in the Varsity Swimming Team. The A.F.C.A. medal and scroll was presented to Cadet Hull at a ceremony at the Institute on May 8. Mr. John Adams of the New England Chapter of A.F.C.A. made the presentation.

THOMAS GILBERT NORRIS

Thomas Gilbert Norris, Air Force ROTC, had the highest academic average of all seniors in chemical engineering graduating this year at the University of Oklahoma. He was the recipient of a National Science Foundation Fellowship, and was a member of Tau Beta Pi, Sigma Tau, Phi Eta Sigma, Phi Lambda Upsilon, Omicron Delta Kappa, Society of Automotive Engineers, Petroleum Engineering Club, and Engineers Club. A member of Beta Theta Pi, social fraternity, Mr. Norris also participated in Union Activities Board, Westminster Fellowship, and Arnold Air Society. Mr. Norris was born on September 29, 1934, in Los Angeles, California. His parents, Mr. and Mrs. H. J. Norris, reside at 1861 Whitley Avenue, Hollywood, California.

ALLAN EVANS JONES

Allan Evans Jones, Naval ROTC cadet, has maintained a very high scholastic average as a chemical engineering student at Ohio State University. He held the office of Treasurer of the Freshman Class Council and has been President, Vice-President and Secretary of Delta Upsilon Fraternity. Other organizations to which he belongs are Anchor and Chain, Phi Eta Sigma (Freshman scholarship society) and the Council of Fraternity Presidents. He has also participated in the NROTC Drill Platoon and served as NROTC Battalion Commander. Midshipman Jones, who was born on January 24, 1935, in Columbus, Ohio, was the recipient of a scholarship from the Standard Oil Company of Ohio.

DONALD KITTS McCORMICK

Donald Kitts McCormick, Air Force ROTC cadet who was graduated this year from Purdue University, was born on December 17, 1934, in Indianapolis, Indiana. He specialized in chemical engineering and stood fourth among 116 students in his school. At Purdue Mr. McCormick was a member of Tau Beta Pi and Phi Eta Sigma, scholastic honoraries, and Reamer Club and Tomahawk, activity honoraries, as well as the Senior Cabinet. He was also in charge of the "Boilermaker Special," Purdue's fun-making locomotive. As a sophomore he received the Republic Aviatian Award. Mr. McCormick held the grade of cadet colonel, air division commander, which is the top cadet position in a corps of 1,800 cadets. In addition to all these activities, Mr. McCormick worked about 20 hours a week as headwaiter, supervising some 120 waiters in Hall "X."

FRANK ROBERT GUMMERSALL

FRANK ROBERT GUMMERSALL, who was born on May 28, 1934, at Pocatello, Idaho, excels in the field of physics, his major subject, at Idaho State College. A member of the Army ROTC unit, he has attained the cadet rank of Captain and belongs to the National Military Honor Society. Cadet Gummersall has held the position of Secretary of Phi Mu Alpha, musicians professional society. He is a member of the Pershing Rifles Society, the Musician Protective Union, and Xi Theta Tau social fraternity.

JACK HORNER LUNSFORD

JACK HORNER LUNSFORD is an ROTC cadet at the Agricultural and Mechanical College of Texas at College Station, Texas. He holds the cadet rank of Master Sergeant, Sergeant Major of the Corps, and has been Cadet Court Reporter. A chemical engineering student, Cadet Lunsford has participated in the Ross Volunteer Company and has been active in Intramural athletics. He is also a member of Tau Beta Pi and Phi Eta Sigma. Cadet Lunsford, who was born in Houston, Texas, on February 6, 1936, was Texas A & M's delegate to West Point's SCUSA.

JERRY ROBERT MOHRIG

JERRY ROBERT MOHRIG is an ROTC cadet at the University of Michigan where he is majoring in chemistry. An outstanding student, he has been awarded a Regents-Alumni Scholarship, Gomberg Scholarship in Chemistry, Herbert J. Boynton Scholarship, and Hinsdale House Scholarship. He served as Treasurer of Inter House Council, Finance Chairman of Michigras, Treasurer of East Quadrangle 1954, and Alumni Chairman of Hinsdale House, and is a member of Phi Eta Sigma. Cadet Mohrig, who was born February 24, 1936, in Grand Rapids, Michigan, holds the cadet rank of Master Sergeant.

DONALD PHILIP MOORE

DONALD PHILIP MOORE, who was born in Chicago, on May 16, 1934, is a member of the Army ROTC unit at the University of California at Los Angeles. He holds the cadet rank of First Lieutenant. Cadet Moore, who is majoring in mathematics, is a member of Pi Mu Epsilon, mathematics honorary society. He has been awarded scholarships at UCLA and at the Massachusetts Institute of Technology.

RUSSELL LEROY NEILSEN

RUSSELL LEROY NEILSEN, born June 1, 1935, in Omaha, is a junior in chemical engineering at the University of Nebraska. High in his ROTC class of 78, he also has an outstanding scholastic record and is in the top two per cent of all students in his class and college. A Laverne Noyes scholarship was awarded to Cadet Neilsen during the first two years of college and a Susan Greenwall scholarship was granted to him in his junior year. In addition to his participation in intramural sports, including football, volleyball and softball, Cadet Neilsen is a member of the American Institute of Chemical Engineers, Pi Mu Epsilon (mathematics honorary society), and Sigma Phi Epsilon (social fraternity). He holds the cadet rank of master sergeant, highest possible for a junior.

BOBBY C. ROBINSON

BOBBY C. ROBINSON, Army ROTC cadet, majored in biology and minored in chemistry at Wake Forest College, North Carolina, where he was graduated this year. Although he worked part-time to help meet his college expenses, he was very active in Scabbard and Blade, national military honor society. During his senior year he instructed and commanded the crack Drill Platoon of the Wake Forest College Corps of Cadets (Cadet Regiment), attaining the rank of Captain. Listed for commission in the Army Chemical Corps Reserve, he planned to attend the Army Chemical Corps School at Fort McClellan, Alabama, this summer. Mr. Robinson was born in Dallas, North Carolina, on December 11, 1932.

ALDOR CORNELIUS PETERSON, JR.

ALDOR CORNELIUS PETERSON, JR., was graduated this year from Iowa State College, Ames, where he majored in chemical engineering. A member of the Naval ROTC unit, he attained the rank of Battalion Commander, the top midshipman rank which only two students of the unit receive each year. Mr. Peterson, born in Fremont, Ohio, on March 4, 1934, was awarded the Certificate of Merit, Cardinal Key and Iowa Engineer Key. He was President of Beta Sigma Psi, social fraternity, and is a member of Scabbard and Blade, Order of the Sextant, the Knights of St. Patrick, Phi Kappa Phi, Tau Beta Pi, Phi Eta Sigma, Phi Lambda Upsilon and the American Institute of Chemical Engineers. Mr. Peterson served as Navy Float Chairman and also participated in the I. S. Singers, Festival Chorus, Iowa Engineer, Interfraternity Council, I.F.C. Rush Magazine, Social Council, and Navy Open House.

THE DOW STORY

(Continued from page 37)

With such figures dancing through their heads, men in Dow's Texas Division have expanded their operations widely—in size, in research, and in range of manufacture. More than forty basic products have emerged from chemical combinations of sea water, petroleum, gas, salt and oyster shells.

Marine engineers designed a ship from the keel up for the specific purpose of transporting liquid chemicals from Texas to East Coast markets. The leased 18,000-ton "Marine Dow-Chem" was launched early in 1954.

MARINE DOW-CHEM FREIGHTER
Designed and built to transport liquid chemicals, the leased "Marine Dow-Chem" operates regularly between Dow's Texas Division at Freeport and east coast ports.

Dow also launched an expanded program abroad. Looking to South American and other foreign markets, the company organized Dow Chemical Inter-American Limited and Dow Chemical International Limited, both with headquarters in Midland. In Rotterdam, The Netherlands, a wholly-owned subsidiary—Nederlandsche Dow Maatschappij, N.V.—was formed with plans for processing chemicals, plastics and magnesium. Dow associated companies sprang up in Japan, South Wales, India and Mexico.

Affairs took yet another turn: The company built and is operating a government plant at Rocky Flats, Colorado, at request of the Atomic Energy Commission.

In the laboratory, meanwhile, scientists were thinking about man's needs, big and small.

Children continued to wear out their overalls. Chemistry contributed an adhesive that lets mothers press on a patch with a hot iron.

People talked jokingly of a meal of food capsules. Synthesis of essential amino acids placed such pills in the realm of possibility.

"We seem to be somewhere in the early stages of a chemical age," commented President Doan.

It also is a restive age for the world, one that places the chemical industry almost on push button status as a defense supplier. But America's economy continues to grow. The "butter" part of "guns and butter" production has more than justified continued plant expansion.

"Most Important Resource—People"

THE "WORK LINED UP" that Herbert Dow mentioned before he died seems endless. Here is the story in figures of Dow's last decade of expansion:

Research has consumed an average of about three per cent of the company's sales revenue. Annual sales have climbed from $102 million in 1946 to more than $500 million. In the 10 years, Dow has invested $693 million in new plants and facilities. It has created 13,000 new jobs within its own ranks.

We like to think that Dow has grown on its founder's credo that ideas, imagination and hard work spell progress in America's system of free enterprise. Dow has stayed close to native raw materials—and to people.

Leland Doan puts it this way: "I think if you were to ask me the one most fundamental factor behind our growth, I would put it down to the fact that the will to progress is a part of the personality of the Dow Company, and in turn a part of the personalities of those who are responsible for its operations."

And President Doan adds: "We at Dow regard people as by far our most important natural resource."

R.O.T.C. AWARDS

(Continued from page 42)

RICHARD LYDDAN DEGENER

RICHARD LYDDAN DEGENER, a junior this year (1956) in chemical engineering at the University of Illinois, is a member of the Army ROTC. Cadet Degener, who was born June 16, 1935, in Des Plaines, Illinois, is in the top ten per cent of both his college class and his military class. His college activities include Phi Eta Sigma (Freshman Scholastic Honorary), Block I, Interfraternity Council, Phalanx, and Chi Phi Fraternity. He has served as Secretary and Rushing Chairman of the latter organization and was Ordnance Junior representative on the Military Council.

DONALD E. WERSCHKY

DONALD E. WERSCHKY, Chemical Engineering and Business graduate this June from the University of Colorado, Boulder, was a member of the Air Force ROTC unit. Mr. Werschky attained the cadet rank of Major and was Commander and Operations Officer of the Arnold Air Society and a member of the AFROTC Fraternity. He served as Vice-President of Tau Beta Pi, Secretary of Phi Lambda Upsilon, and Treasurer of the college chapter of the American Institute of Chemical Engineers. He is also a member of Alpha Kappa Psi, Alpha Chi Sigma, and Sigma Tau. Mr. Werschky also served as advertising manager of the Colorado Engineer Magazine. His home address is 910 North Custer Avenue, Colorado Springs.

THE IGY—DR. KAPLAN

(Continued from page 27)

the effects of this great increase in carbon dioxide, we must answer two questions: First, how much of the carbon dioxide will leave the atmosphere and go into the ocean and, secondly, how will the carbon dioxide remaining in the atmosphere affect the infrared radiation balance of the earth. The second question is an extremely complicated one, and the best answer will probably come from experience during the next thirty or forty years. It is hoped that the answer to the first question will come from the meteorology and oceanography programs contemplated during the IGY. One of the essential parts of these programs is to study the exchange of carbon dioxide between the air and the sea.

CONSIDERING the aspects of the oceans which I have briefly touched on, it was only natural that a program in oceanography should have been a part of the international plans for the IGY. The areas involved are too vast for any one nation to cover; observations are required not only in large numbers, but simultaneously from carefully chosen places. Advantage should also be taken of the large programs in related sciences such as meteorology, glaciology and seismology.

So little is known about the circulation of the deep ocean water that nobody knows whether it takes a hundred years or ten thousand for this water to travel from the Antarctic to the Equator and back again. Why should we try to learn more about these deep ocean currents? There are several practical reasons—one is that the deep currents may be of great importance in long-range weather forecasting, particularly because of the exchange of water between the Antarctic and low latitudes. Second, the fertility of the ocean depends upon the water exchange between the deeps and the surface; that is, the amounts of fish and other foods we can harvest from the ocean are finally limited by the rate at which the ocean overturns and thereby fertilizes itself. Third, the development of peaceful uses of atomic energy will probably result in the production of unbelievable quantities of radio-active substances, and somehow these must be safely disposed of. As I have suggested above, one possible thing to do with them is to dump them into the deep sea; its currents might spread them out to such an extent that they would be harmless. But we really don't know whether this would be true or not because we don't know how fast the deep waters move or how they mix with waters near the surface.

Investigations in meteorology, oceanography and glaciology range from studies of the ocean depths to meteorological effects reaching up to about 100,000 feet. The high atmosphere, extending from above this height and thinning out to nothingness hundreds of miles above the earth, also plays a dominant role in the lives and civilizations of the world. The atmosphere provides a shield against lethal radiations from the sun and equally dangerous cosmic radiations. The heat balance of the earth is maintained by the atmosphere, which regulates heat radiation and holds surface temperatures to a range suitable to life on the planet.

Many geophysical phenomena of fundamental importance occur in the high atmosphere of the earth. The fields of geomagnetism, aurora, ionospheric physics, and cosmic ray research are all directly related to the events which occur at heights higher than 50 miles above the earth.

The sun dominates many of these events. Solar flares and other eruptions from the sun create havoc with long distance radio communications and produce the brilliant aurorae prevalent in polar regions.

SOME SOLAR EFFECTS are obvious—for example, seasonal weather changes and the temperature differences between the equator and the poles. Short period fluctuations in solar activity are not particularly important in these connections. Less obvious, but of equally great significance, are the effects of solar activity on the upper atmosphere. Unusual solar radiation, either in intensity or in kind, strongly influences the upper atmosphere and, indirectly, radio communications, navigational systems and many other normal civilian activities.

Over-all solar activity is measured by the 11-year sunspot cycle. Many other solar phenomena, such as enormous flares, prominences and other types of active regions vary according to the same time scale. Individual sunspots or other active regions on the sun have lifetimes of a few days to a few months, changing rather gradually during that time. Spurts of activity, common during high activity states of the 11-year cycle, occur in some individual solar regions and last up to a few hours or a few days, with individual outbursts or flares lasting only for a few minutes.

Variations in each of these activities are associated with events on the earth. Partly for this reason the IGY program was timed to occur close to the peak of the sunspot activity so that the intensity and frequency of the associated geophysical events in the high atmosphere would be increased and could be correlated with the sources of these disturbances on the sun.

Solar activity during the IGY will be studied with a network of observing stations which will measure not only events occurring in the range of visible frequencies, but those at radio frequencies. Stations have been spaced around the world so that a continuous 24-hour watch of the surface of the sun can be made. In some locales stations are more closely spaced in order to assure continuous monitoring of the sun during periods when cloudiness or other difficult "seeing conditions" might cause the patrol to be interrupted. These stations will make counts of the numbers and sizes of sunspots, will study the sun's corona for unusual events and greater intensification of activity, and will record the enormous solar flares which sometimes shoot out hundreds of thousands of miles at tremendous speeds. Other station will make recordings at radio frequencies of solar noise, which is an indication of unusual activity on the sun.

While these types of solar events are known to correlate directly with ionospheric and geomagnetic disturbances, auroral displays, and cosmic ray showers, the details of the correlations remain hazy. The systematic observations of the sun are expected to provide a more direct understanding of the relations of solar and terrestrial events. At the same time it is planned to use this network of patrol stations as a means to forecast or anticipate unusual geophysical disturbances in the high atmosphere. An international "Warning Service" will be established. Special "World Intervals" will be singled out during which observations of terrestrial phenomena will be accelerated. During these intervals, geomagneticians, cosmic ray specialists and physicists in the auroral and ionospheric programs will greatly accelerate the number of their normal recordings and observations. A communications network is being established which will broadcast the onset or presence of disturbed conditions in the high atmosphere, signalling observers to proceed with their special studies.

LONG DISTANCE radio communications, as for example between New York and London, depend for their success on a region of rarefied, ionized gases, high in the atmosphere. This region, which exists at levels 50

to 250 miles above the earth, is known to physicists as the ionosphere. Radio waves emitted from a transmitter at one point on the earth's surface strike this region and are reflected, much as a mirror reflects light, to radio receivers many hundreds of miles away.

From the days of Marconi, who sent the first long-distance radio signals between this continent and Europe at the beginning of the century, our modern civilization has been steadily more dependent on the ionosphere for communications, radio telephony and radio navigation. Yet the existence of the ionosphere which enabled Marconi's signals to get through was only an hypothesis until 1925, when Breit and Tuve demonstrated that a radio signal sent directly upward could be returned to an adjacent receiver.

Since that time, ionospheric physicists have been exploring the nature and characteristic of this electrified region high over the whole earth and have learned that it is an area of extreme complexity, constantly changing, and subject to many external influences. Within this region are layers of dense ionization which change radically with time of day, with season, and even from year to year. Moreover, the characteristics of the ionosphere vary markedly at different locations over the globe.

Ultarviolet light from the sun is the principal agent which accounts for the ionosphere. This incoming radiation knocks out electrons from the sparse atoms high in the atmosphere, creating the electrically-active ionosphere. But it is well known that the sun's radiation is extremely variable, both from day to day and over the long 11-year sunspot cycle. Many other geophysical phenomena, such as geomagnetism, the aurora, and perhaps meteors and thunderstorms, are directly related to the behavior of the ionosphere.

A solar flare on the sun is often immediately followed by an ionospheric disturbance which effectively disrupts communications. Long-distance radio communications may be completely blotted out or very substantially limited. Active sunspots may be followed by a period of intense geomagnetic storminess or violent auroral displays, and concurrently by major paralysis of long-distance communications. This is particularly true in the higher latitudes where effective communications frequently have been known to be unsatisfactory for periods as long as several days continuously.

The IGY pattern of ionospheric observing stations has been carefully planned to provide a global picture of the "normal" ionospheric regions, as well as to study the equally important geophysical factors associated with radio storminess. These stations send waves out vertically overhead and receive the reflections from the ionosphere at an adjacent receiver. This program will be supplemented by oblique measurements which will extend the area of exploration from about 600 to 1,200 miles around each location.

THE INFORMATION FROM this network of ionospheric sounding stations will be assembled into world-wide patterns (much as a meteorological map is constructed) from which reliable radio communications can then be developed. Predicting the future state of the ionosphere is one of the major problems in ionospheric physics. The prediction must indicate whether or not direct contact will be possible, the frequencies to be used if the possibility is good, or the practicality of resorting to alternate "radio routes" for vital communications.

One of the most important aspects of ionospheric research is that planned for the Antarctic. Soundings of the ionosphere have never before been made in this region where the sun is absent during the long winter months. Radiation from the sun is known to be the principal agent in breaking up the sparse atoms in the atmosphere at ionospheric heights so that reflection of radio waves is possible. During the long Antarctic night, however, particularly at the South Pole, the sun's radiation is absent. Scientists have no good explanation to account for the continued existence of ionized regions in the high atmosphere under these conditions and eagerly await the chance to study the composition and characteristics of the ionosphere in this unique situation. The opportunity to make continuous ionospheric soundings over a prolonged period in Antarctica under these conditions offers the promise of contributing valuable new information to expand the scientific theories.

At the present time there are about 75 vertical incidence ionospheric sounding stations in operation around the world. About an equal number will be established during the IGY in order to fill the gaps in the observing network. With the information received from this expanded chain of stations, we can confidently expect that far more accurate predictions can be made concerning the behavior of the ionosphere and its usefulness in long-distance radio communications.

The United States now operates or supports 17 stations within the regions of its own national interests. During the IGY it will be responsible for the establishment of 17 additional stations. Several stations will be established in the Antarctic and two in the Arctic, the latter at Thule, Greenland, and at a sea-ice location north of Alaska. In addition, stations will be established at St. Johns, Newfoundland; Florida, and in the Pacific. Four stations will be established cooperatively with South American countries in order to complete the coverage of the 70°-80° longitude chain. An intensified research program will be undertaken along the west coast of South America in the region of the geomagnetic equator since very unusual and unexplained effects of vital importance to radio communications occur about this equator.

Storms at sea and in the atmosphere are familiar enough. The earth itself appears solid and stable, but this is far from true. The earth is subject to continual stresses and strains, related in large measure to its varying composition. Violent earthquakes reveal dramatically from time to time the existence of these stresses and strains, but the large number of earthquakes noted by instruments provides proof of the variability of the earth. Thus more than 250 earthquakes were recorded in the United States alone during 1953.

DURING THE IGY three fields relating to the earth's crust and interior will be studied: Studies of seismology, which is concerned with earthquakes and similar events, will be conducted in remote regions. Measurements of gravity, the pull of the earth, will be made in areas where observations are now lacking—particularly in the Antarctic and certain parts of the oceans. Determinations of latitudes and longitudes will be made at selected points, using both conventional astronomical techniques and a new photographic technique involving the moon.

Although man seems helpless where such physical events as earthquakes are concerned, actually he can lessen the damage done by such disasters by improving his knowledge of their nature, by finding out how likely they are to occur in particular locations, and by determining how extensive they may be.

Earthquakes are caused by "faults" deep within the crust of the earth. These giant cracks are left over from the prehistoric days when mountains were thrown up and great canyons formed in the bottom of the oceans. The faults are scars which have not yet healed com-

pletely, flaws under the surface where the earth has not yet settled down. In 1940, for example, the San Andreas Fault in California stirred and settled a bit and shifted the U. S.-Mexican border almost ten feet. Thirty-four years earlier the same fault produced the San Francisco earthquake of 1906 with a death toll of 700 and property damage of $400,000,000.

Earthquakes in the depths of the ocean sometimes cause huge tidal waves, or seismic sea waves. Advance warning of the tidal wave which hit the Hawaiian Islands in 1946 would have saved many of 170 lives lost and decreased the property damage, which amounted to $25,000,000.

Microseisms, the much smaller tremors of the earth's crust, result from physical occurrences nearer the surface of the earth. The energy from atmospheric disturbances joins with that of the earth's surface, usually through oceanic waters, to jar the earth with a series of small shocks, which are recorded as background vibrations on such instruments as seismographs. Man can cause minor earth shocks, large enough to be recorded by seismograms, by means of explosives.

Earthquake waves and explosion waves provide information about the thickness and layering of the surface of the earth. In addition, seismographs can record the thickness of ice in such a place as the Antarctic, thereby giving scientists knowledge of the actual profile of the continent under the ice. Seismologists study earthquakes to determine their mode of formation, their exact locations, and the energy released. This, they expect, will enable them to develop prediction methods for times of occurrences and location. They hope also to increase their knowledge of the structure of the earth, its crust, its outer and inner shells, and its core; and they want to learn more about microseisms.

Seismological studies have long been conducted on an internationally cooperative basis. The IGY gives scientists the opportunity to make addition measurements in remote areas, particularly at Antarctica and the equatorial Pacific islands. Virtually no measurements of this type have been made directly on the Antarctic continent. Seismographic instruments elsewhere in the world have shown that some of the largest earthquakes have occurred in the sub-Antarctic region, and earthquakes are occurring on the continent itself.

U. S. scientists will set up their instruments in the Atlantic and the Pacific as well as on the North and South American continents and in Antarctica. They will record natural earth tremors and earthquakes; and they will make their own artificial tremors with dynamite charges in order to measure ice thickness in the Antarctic. The U. S. information, combined with that of worldwide seismic studies by other nations participating in the IGY, will enable scientists to make a much better map than they have now of the interior of the earth.

UNTIL RECENTLY, studies of the upper atmosphere have been seriously handicapped because direct observations and measurements were impossible. Conventional balloon techniques, like those used in weather observations, do not extend beyond some 24 miles, and so studies of the upper atmosphere have depended upon indirect measurements such as those made in probing the ionosphere. Here, pulses of radio energy, similar to radio pulses, are sent up to the ionosphere some 50 to 200 miles above the earth's surface. These pulses are reflected back, and by measuring the time of travel scientists can tell something about the reflecting features of the ionosphere while by analyzing the reflected signal something of the composition of the ionosphere can be determined.

The need for accurate information from the upper atmosphere calls for direct measurements, and this can only be done by sending instruments into the region that is being explored. Rockets and satellites are devices that permit man to send his instruments into the high regions of the atmosphere.

The development of rockets during and after World War II has resulted in a variety of devices useful for atmospheric research at high altitudes. Altitudes of about 60 miles can be reached by balloon-launched rockets, called rockoons. These small rockets are fired from balloons once the latter have reached their maximum height. Larger, ground-launched rockets are available that can attain greater altitudes. The Aerobees, which are to be used in the U. S. program, can travel to a height of approximately 200 miles above the earth's surface. Somewhat similar rockets have been, or are being developed by other nations and are to be used in the IGY program.

Rockets have already been successfully used, particularly by scientists in the Department of Defense, to study the outer atmosphere. Certain solar radiations, for example, which are absorbed by the atmosphere and hence never reach the earth's surface, have been investigated. A rockets measurement led to the discovery of solar X-rays in one of the ionospheric layers. Measurements of ultraviolet radiation have established the variation with height of the ozone in the atmosphere up to an altitude of 42 miles. What are believed to be auroral particles have been detected by rocket-borne geiger counters, and the density of charged particles in the ionosphere has been measured directly.

THE IMPORTANCE of rocket measurements is three-fold: first, it provides direct measurements of events in the high atmosphere; second, these direct measurements permit us to upgrade the indirect data collected more economically from many ground stations, greatly increasing its value; and, third, new discoveries are possible—like the discovery of X-rays in the ionosphere.

A variety of studies will be undertaken in the U. S. rocket program. Investigation of the structure of the atmosphere will include measurements of pressure, temperature, density, and winds. Special instruments will be used to measure the chemical and ionic composition of the atmosphere. Particles and radiations from the sun will be observed and measured, including the nature of auroral particles. Variations in the nature of the ionosphere will provide information on the electrical currents flowing in the lower ionosphere.

Some 600 rockets will be launched, including Aerobees that reach an altitude of about 200 miles and Rockoons that travel some 60 miles above the earth. Most of the Aerobees will be fired from Fort Churchill in cooperation with Canada, and some from White Sands and Alamogordo, New Mexico. Rockoons will be launched from shipboard in many areas, including waters off the Antarctic coastline, off the west coast of North America, in equatorial regions, and in Arctic waters. This basic program will be supplemented by launchings of small rockets assembled as two-stage combinations, Nike Deacons, which are scheduled for release from both Fort Churchill and White Sands. There are also plans to release small rockets, so-called Rockairs, from high-flying airplanes. Attempts will be made to launch these rockairs during periods of increased solar activity and the outbreak of solar flares. The launching schedule of the U. S. rocket program is being closely coordinated with all other IGY studies and special firings will be centered around days of unusual solar activity.

While rockets provide crucial information about the upper atmosphere, rockets have two limitations. First,

their total flight is extremely short while the time spent in a particular altitude range is even shorter; and, second, rocket coverage is limited to a small part of the earth. Thus, in spite of the great value of rocket data, much of which can only be obtained by rockets, there is a need for a tool which can provide data over a long period of time, over considerable heights above the earth, and over large expanses of the atmosphere about the earth.

A SATELLITE can achieve these objectives, and for these reasons several international bodies strongly urged inclusion of satellites in the IGY effort. The satellite, in effect, represents an extension of rockets, which led me to call our satellite program the "LPR"—long-playing rocket.

The U. S. satellite program calls for the launching of twelve satellites in conjunction with the IGY. The program developed by the National Academy of Sciences, and presented to the Government for support, includes major logistics contributions from the Department of Defense, particularly in the development of the launching rockets, the actual launching of the satellites, and related support facilities and assistance. Civilian scientists in the Department of Defense and in many public and private research institutions are cooperating in the scientific program. Contracts have already been issued by the Navy, which has management responsibilities for the contributions of the three military services to the satellite effort, for the development of rocket-propulsion vehicles.

Satellite launching will be from the Patrick Air Force Base on the east coast of Florida at Cape Canaveral. A three-stage rocket assembly will provide the means of getting the satellite into its orbit. The first stage, providing a thrust of 27,000 pounds, will start the system on the first part of its flight. When its fuel is exhausted, some 40 miles from the launching site and within about two minutes after take-off, the system will have attained a velocity of 3,000 to 4,000 miles per hour. The second rocket stage will then take over, attaining a velocity of about 11,000 mph, burning out at about 130 miles altitude, and coasting onward. When the system has reached an altitude of about 300 miles, the last rocket will impel the satellite into its orbit at a speed of about 18,000 miles per hour.

This orbit will be inclined approximately 40 degrees from the equator. Both technical and functional considerations were involved in the choice. Because optical measurements will play an important role in observations of the satellite, intermediate latitudes appeared desirable, for the opportunities to observe the satellite by many nations over its entire course are thereby enhanced. In terms of observational stations a true equatorial orbit provides simplicity as against a true polar orbit. However, the equatorial orbit precludes appreciable latitude coverage and atmospheric conditions limit the possibilities for optical observations, while a polar orbit reduces opportunity for continuous observations from a practicable set of fixed observation stations.

THIS ORBIT will permit the satellite to revolve about the earth in an apparent latitude range of about 40 degrees on either side of the equator. As it revolves about the earth once every hour and a half, the earth will rotate beneath. Since the earth rotates about its axis once every 24 hours, it will have made about one-sixteenth of a revolution each time the satellite orbits once completely. If the orbit of the satellite were circular, one-sixteenth of a revolution, or 22.5 degrees, would be approximately accurate. The orbit is to be elliptical, however, so that more than one-sixteenth of a revolution will be made by the earth during one revolution of the satellite: the displacement will be about 25 degrees. Thus, after one revolution, the satellite will appear about 25 degrees west of its launching site, 50 degrees west on its second passage, and so on.

This means that over the course of many revolutions, the orbit of the satellite will shift within a band between 40 degrees north and 40 degrees south of the earth's equator. Two important advantages accrue from such a course:

First, the satellite's instruments will be able to record observations over a broad expanse of the high atmosphere. Such coverage is important to the International Geophysical Year program, for the primary objective of this unprecedented cooperative study is to secure data all over the earth and its atmosphere.

Second, the excellent bandwidth coverage will permit the scientists of a large number of nations to take measurements and to make observations. In the planned orbit the satellite will be observable from the United States, Central and South America, and Africa; southern Europe and possibly some regions in mid-northern latitudes; the Balkans and Middle East; the Caspian Sea and part of the USSR; Pakistan, China, Japan, India, and several other countries in Asia in the mid-northern latitudes; Indonesia, Australia and New Zealand. The U. S. National Committee hopes that later satellites may be launched so as to permit scientists of additional nations also to participate in the study.

Aside from the possibility of other orbits for future satellites planned by the U. S. National Committee, which will permit even broader IGY participation, radio observations extend the possibilities of satellite observations even in its present latitude range. The United States plans to have radio observatories, in addition to optical stations, in order to follow and study the satellite. The radio system calls for a transmitter in the satellite, and these signals can be picked up by the IGY participating nations for tracking purposes; the nature and design of the radio system, as well as of the frequencies, will be furnished to CSAGI and all other interested nations. The probable maximum range of these signals is expected to be between approximately 1,000 and 3,000 miles in all directions, depending upon the altitude of the satellite. Reasonably good position determinations can probably only be obtained no farther than about 800 miles away.

Visual observations will also be possible—both with the unaided eye under optimum conditions and, preferably, with binoculars. U. S. stations will have special optical cameras for precise observations. Information on this equipment will be announced once the details have been developed.

THE FIRST satellite will be spherical in shape, between 20 and 30 inches in diameter, and will weigh approximately 21.5 pounds. Although a spherical shape complicates the design of the over-all system, this shape is of considerable interest for measurements of air density. Of the satellite's 21.5-pound weight, about half will be required for the structure itself, leaving half for various instrumentation, including the telemetering systems which transmit information by radio to ground stations. Eight experiments will be undertaken: air density, composition of the earth's crust, geodetic determinations, temperature and pressure measurements, meteortic observations, studies of extreme ultraviolet radiations from the sun, and cosmic ray intensities. Other experiments are being planned for additional satellites.

Very little is presently known about the density of the upper atmosphere. The flight of the satellite, which

in altitude will range from about 200 miles at its nearest point to the earth to a maximum of about 800 miles, for the path will be elliptical, provides an opportunity to study this feature of the atmosphere. Even at these altitudes there is some atmosphere, which will exert a drag effect. From the geometry of the satellite and observations of its flight, calculations can be made of the air density.

The satellite, once it is launched into its orbit by the third rocket stage, will proceed under its own momentum in an elliptical orbit around the earth. Its speed of about 18,000 miles per hour produces a centrifugal force which counteracts the earth's gravitational pull. This pull is an effect of the mass of the earth, and because there are geographic variations in the mass of the earth—for example, the bulge at the equator—there will be variations in this pull. These variations will create small perturbations in the satellite orbit. Careful observations and calculations of the orbit will thus yield information on the mass distribution of the earth. This, in turn, will tell something about the composition of the crust.

Determinations similar to those noted above will provide data about the oblateness of the earth, that is, the bulging at the equator. This will yield a better picture of the shape of the earth, which is presently not known accurately enough. At the same time, synchronized observations of the satellite may permit improvements in determinations of longitude and latitude. These observations would significantly supplement the observations that are planned in the IGY longitude and latitude program, involving synchronized observations of the moon.

Measurements of temperatures within the satellite and at its surface will be made. This is of interest primarily in terms of the operating environment within which instruments must function. The heat within the satellite is derived largely from solar radiation, some from the power supplies, some from thermal radiation emitted by the earth, and a very small amount from friction.

The satellite shell will be airtight and it will contain an inert gas. Pressure gauges will be used to measure pressures during the satellite's life in order to check on leakages and in connection with possible meteoritic effects.

SMALL MEOTORITIC particles, a few thousandths of an inch in diameter, are constantly impinging upon the earth's atmosphere. Although they doubtless enter with great speed, impacts with molecules of air soon slow them down, and then they drift to the ground. Estimates as to the quantity reaching the earth's surface vary, some reaching as high as 1,000 tons per day for the whole earth. These micrometeorites, as they are called, are believed to contribute a measurable, though small, amount to ionizing the atmosphere in the E-region. With the use of simple impact detectors these micrometeorites can be observed. Moreover, measurements of pressure within the satellite will reveal meteorite peneration and some information on size.

Much of the radiation from the sun is masked from the earth by the atmosphere, largely through absorption. This is particularly true of the extreme ultraviolet radiations in the Lyman-alpha region, 1216 Å (one Ångström equals one-hundredth of one millionth of a centimeter, or about 0.004 millionths of an inch). The satellite offers an opportunity to observe this radiation on a long-term basis and thereby to determine the influence of solar flares on its emission from the sun. It may be possible simultaneously to make similar observations from some direction other than that to the sun. By correlating the intensities observed directly from the sun with those observed off at an angle, it should be possible to estimate the average density in space of hydrogen atoms and ions.

Cosmic rays are high energy particles impinging in large numbers upon the earth and coming from interstellar space or the sun. Although all of these particles have high energies, there are variations in their energy content. Because the earth's magnetic field deflects these particles, only those with the highest energies penetrate the mid-latitudes. Moreover, many of the low-energy particles are absorbed in the earth's atmosphere, and observations of cosmic rays are generally of "secondaries" created by "primaries" bombarding atmospheric atoms. The satellite will permit direct studies of primary cosmic rays above the masking atmosphere.

Scientists of many nations began to consider the IGY as early as 1950. To effect international coordination of the technical effort, the International Council of Scientific Unions established a special committee in 1952, called the Comite Special de l'Annee Geophysique Internationale (CSAGI). The CSAGI called upon the nations of the world to establish national committees to plan and direct their countries' effort. The criteria and nature of the IGY endeavor were established at a series of meetings, beginning in 1953, of delegates from the various national committees. Emphasis was placed on those measurements and observations which required simultaneous study all over the world and on epochal measurements which would reveal long-range trends and changes in man's physical environment. Within this framework, each nation planned its own program.

IN THE UNITED STATES, the National Academy of Sciences is the adhering body to the International Council of Scientific Unions. The Academy established the U. S. National Committee for the International Geophysical Year, under my chairmanship, to plan and direct the U. S. effort. This Committee, with its special regional committees and technical panels, gathered the Nation's leading scientists in geophysics to develop and execute this major research undertaking.

The National Academy of Sciences turned to the National Science Foundation for Government assistance, and funds were requested from Congress through the National Science Foundation, which is the agency responsible for Federally supported basic research. Congress appropriated two million dollars for the purchase of long lead-time equipment in 1955, and ten million dollars were appropriated in 1956. Recently, Congress has appropriated an additional 27 million dollars, the bulk of which is for the Earth Satellite Program.

Although the IGY formally begins in July, 1957, climatic and environmental conditions in the Antarctic called for an early start in this region by the eleven participating nations. In the winter of 1954-55, the Navy dispatched the USS Atka to study sea ice conditions in the Ross Bay and to establish a site for the new Little America station. The Atka discovered that bay ice in the Ross Sea, some forty miles in depth, had broken off, precluding use of the earlier Little America sites. A new site was found at Kainan Bay.

During this last winter, several icebreakers, several cargo vessels and aircraft undertook the Antarctic mission known as "Deepfreeze I." The station at Little America was established, and an aircraft facility was set up at McMurdo Sound, in anticipation of the airlift of the South Pole station in the autumn of 1956. Instruments, supplies and facilities for the Byrd station in Marie Byrd Land and the South Pole station were stored at Little America and at McMurdo Sound.

Both missions to the Antarctic also undertook scientific work in many of the fields of the IGY. These studies have already produced valuable scientific information, particularly in the fields of cosmic rays, meteorology, and "whistlers"—the strange audible signals that travel thousands of miles through outer space from one point on the surface of the earth to an opposite one on the other side.

With forty-eight nations actively participating in the IGY, and with thousands of scientists planning studies all over the world, the IGY is destined to yield unprecedented knowledge about the mysteries of the earth and the atmosphere and their relationship to the sun. In geophysics, the universe itself performs the experiments in which man is interested. The events that determine our physical environment are therefore worldwide in nature and only through the cooperative efforts of all peoples can their secrets be discovered. Thus, through this joint effort of many nations, there is ample assurance that man will better learn the nature of his environment from the depths of the earth to outer space.

DR. FROLICH

(Continued from page 21)

process design stage. However, as all of you know, a prototype item is not always readily suited to the requirements of mass production. To assure this mass producibility we now have an Engineering Command within the Corps. Under the command of Colonel William J. Allen, and with agencies at the Army Chemical Center and at Fort Detrick, the Engineering Command works to insure that the item is ready for production, lends itself to mass producibility, and is properly engineered.

MUCH OF WHAT I have said up to this point about our research and development operations and problems, apply also to the field of engineering. From the very start, the engineers work very closely with the research and development people on a project to insure that the necessary engineering and production validity is built into the item. It serves as a link between the research and development stage and the production plant. Even after an item has gone into production, the Commanding Officer of the Engineering Command acts as a consultant to the Commanding General of the Materiel Command and advises him on what is new in the way of processes and equipment for producing the item. The same pattern is followed in the case of chemical process development, engineering and manufacturing.

This brings us into the supply and logistical phase of our work, another major facet of the Chemical Corps' mission.

To accomplish this phase, the Office of the Chief Chemical Officer has a Logistics Planning Division which performs the staff functions in supply planning, similar to that performed in overall doctrinal and requirements planning by General Currie's office. The field installations responsible for the Corps' operations in this area are under the jurisdiction of the Materiel Command. As many of you know, the Materiel Command, which is headed by Brig. General Marshall Stubbs, has recently moved its headquarters from Baltimore to the Army Chemical Center.

The Materiel Command is responsible for the operation of our various arsenals, for the procurement of items from industry, and for the maintenance and storage of all the various items supplied to the Armed Services by the Chemical Corps.

Although it is the policy of the Government to procure materiel through industry wherever possible, the nature of some of our products require that we continue to construct and operate certain types of production plants.

That, very briefly, is how we operate in that portion of our mission which can be likened to industry.

In the more purely-military area there is the responsibility for training. This part of our mission requires us to train certain officers and enlisted men, not only from the Chemical Corps personnel, but also from other branches of the Army, the Air Force, the Navy and the Marines. This function is accomplished under the direction of General Currie—the Assistant Chief Chemical Officer for Planning and Doctrine—at the Training Command at Fort McClellan, Alabama. In charge of this Command is Colonel Thomas H. James.

Another aspect of personnel development and training is a broad program of career management for both military and civilian personnel which is coordinated by the newly-formed Career Management Division in the Office of the Chief Chemical Officer. This division was set up as a result of the ad hoc committee's specific recommendation. Although the Corps has always had a career management program for the civilian and military personnel, the creation of the new division centralizes this program so as to make it much more effective.

IT IS INTERESTING to note that this training phase of our mission is not unlike that found in industry, where courses are given to better train employees for their jobs, and personnel management programs are set up to provide a constant source of executive staff people.

An important phase of the program for career employees is the offering of both graduate and undergraduate courses at our installations under contract with the faculties of neighboring universities. Besides increasing the competence of employees whose professional education has been interrupted due to causes beyond their control, this inservice training program permits those who are competent in one specialty to broaden their training into other disciplines. Such training in multiple fields is becoming increasingly important because of the growing complexity of science and technology. For this educational program to be successful, it needs the wholehearted support of every level of administration. We try to impress upon our own people that the performance of a supervisor should in no small measure, be judged by his success in improving the performance of the men under him.

By now, I think you can see why I said in my opening remarks that our method of operation, in many respects, can be compared to that of a chemical firm. And, this leads me to the observation that we in the Chemical Corps work closely with industry. This is done through the medium of contracts and with the widest possible use of individual consultants and advisory groups, for much thought and planning is required if we are to be prepared to exploit fully the tremendous capacity of the nation's chemical and allied industries in time of national emergency. In this regard, I am speaking of the type of planning and preparation which will enable industry to contribute directly and speedily to the capabilities of the United States to defend against chemical or biological warfare attack. It is an area where we, of course, are counting heavily on the support of this Association.

Views On Cml. Corps Mission

At this point I would like to discuss some personal reactions and observations as they may pertain to the mission and organization of the Chemical Corps.

In my years as a teacher and industrial scientist I had little more than an academic interest in the fields of toxicological warfare. Even during the years I spent as a part-time consultant to the Chemical Corps, my interest was centered in individual projects rather than the overall concepts of the meaning of the Chemical Corps' mission. I'll admit, gentlemen, that the past year and a half during which I have been a member of the Corps has been an education.

I am reminded of the reaction of a colleague in one of the other Army Technical Services who listened to me present a review of some of our research activities during a briefing. Later he looked me straight in the eye, shook his head, and exclaimed: "You Frankenstein!" Maybe a few years ago, I too, would have adopted such an attitude. Today, however, I would counter this feeling by saying that I do not know whether there is such a thing as "humane warfare" but that, in any case, ours are among the *least inhumane* agents of warfare of which I have any knowledge. In some ways this may sound like a rather positive statement, but that is my conviction.

IT IS APPARENTLY true that an adverse reaction to chemical weapons is the rule rather than the exception in the United States today. If one really thinks the matter through and compares various means of warfare, it becomes rather obvious that the most horrible aspect of warfare is the way it affects people as individuals, as well as their material possessions. I have in mind personnel maimed for life; whole cities destroyed, and nations having to be completely rebuilt or reconstructed by the so-called victors. Perhaps, if we, as a world civilization, are unfortunate enough to continue to be cursed by having to fight wars, we should turn our thoughts toward weapons which will enable us to emerge the victors with the least cost in lives and destruction of material objects—I mean in terms of the enemy's lives and economic facilities as well as our own.

One of the most succinct statements of what I consider should be democracy's as well as our entire civilization's—attitude toward war was made by Dr. W. K. Lewis, former chairman of the Department of Chemical Engineering at the Massachusetts Institute of Technology. Many of you will recall that Dr. Lewis made significant contributions to the U. S. war effort during both world wars.

In a speech delivered in Atlanta some twenty-five years ago, he said: "The aim of war is the destruction of the enemy's will to resist. This aim cannot, in general, be achieved without causing both suffering and death, but these should be considered only as unavoidable, concommitant results of war and, as such, kept at the lowest possible point consistent with the attainment of the major purpose. The only known method of breaking down the will to fight of a determined foe is by putting a certain percentage of his troops out of action, rendering them physically incapable of resistance, or, in technical phraseology, producing casualties. The measure of the efficiency of a weapon in war is its capacity for producing casualties . . ."

If you accept the soundness of Dr. Lewis' analysis, I think we can agree that the weapons systems with which we in the Chemical Corps are concerned meet his requirement. We are certainly directing our efforts to this end. And, while no organization can be termed perfect, I am confident that we are now even better equipped to do the job expected of us.

We, the Army Chemical Corps and the American chemical and allied industries, have a big job to do. For, until the formula for lasting international peace is worked out and in operation, we must be prepared to preserve our integrity as a nation against all odds. The advent of the means of nuclear warfare have not detracted from the value of the chemical-type weapon; if anything, it has enhanced its position because of the very awesome destructiveness of nuclear weapons. By turning away from the thought of destructive weapons, we can see that there are weapons—the toxicological variety—which can accomplish the same purpose as other means of warfare without the great destruction that usually has accompanied warfare.

BUT, BECAUSE the term "chemical warfare" has not been considered polite in our society there is a lack of understanding about it. One of the major aims of the Armed Forces Chemical Association could be to educate the American people in this field. The job that here faces the Chemical Corps and the chemical industry, is to make the most of what we get and have in men and money. In order to get more research for each dollar spent, the Chemical Corps has attempted to take the best that industry can offer in the ways of management and adapt these ideas to its own organization.

From time to time we see mentioned in an industrial firm's annual report to its stockholders, that some 60% or so of the firm's sales and/or profit is derived from products less than 10 years old. I know of no similar data on our military materiel, but I think you can get a pretty good picture of the situation for yourself by comparing weapons and methods of warfare employed in World War I with those used in World War II, and then, in turn, with those under development today.

The ad hoc committee dwelt on the concept of an uninhibited and imaginative research program. In dedicating the great new General Motors Technical Center recently, Mr. Harlow H. Curtice introduced the concept of dynamic obsolescence as an important factor contributing to our current rapid industrial progress. Let me conclude by saying that the Chemical Corps must dedicate itself to the pursuit of a dynamic program in research, development and engineering in order to keep abreast of the accelerated obsolescence with which we are confronted in this technological age.

A CENTURY AND A HALF OF SERVICE

Recent retirement ceremonies in the Chief Chemical Officer's Office for Mrs. Jessalyn Gage (3rd from L) became "homecoming" with the visit of "alumnae": Mrs. Edna Summerfield, Miss Ruth La Foy, and Miss Irene C. Boyne (1st, 5th and 6th from L). Between them, these ladies have seen about 150 years of Chemical Corps service; one, Miss La Foy, dates her Corps employment from Armistice Day, 1918.

Shown here with them are Col. Melvin W. Reed, Administration Division Chief; General Creasy, and Mr. Edgar A. Crumb, Executive Director.

A. F. C. A. CHAPTERS

CINCINNATI:

Officers Elected at Luncheon Meeting

Mr. John T. Yoke, research chemist with Procter & Gamble, was elected president of the Cincinnati Chapter of the A.F.C.A. at a luncheon meeting held on May 22.

Mr. C. E. Trotter of the American Laundry Machinery Company and Major Gordon Rich were elected vice presidents. Mr. F. L. Diehl, chemical engineer with Procter & Gamble, was made secretary-treasurer.

MIDWEST:

Mr. E. F. Binkerd Heads Chapter

Mr. E. F. Binkerd was elected president of Midwest chapter at its annual meeting held at the quarters of the Western Society of Engineers, 84 Randolph Street, Chicago, on June 1. Other officers elected were Mr. Gaillard Rumford, 1st vice president, Mr. Harry Morley, 2nd vice president and Mr. James J. Doheny, secretary-treasurer (reelected). The following were named directors of the chapter for the ensuing year: Messrs. Morton Hague, Lewis I. Terry, Ray G. Sobottka and C. H. McNary.

A special feature of the meeting was an address by Mr. Harold Cheadle, economist with the Federal Reserve Bank of Chicago on "The Current Business Outlook."

NEW YORK:

W. Ward Jackson is New President

Jackson

Sheridan

Eddy

Mr. W. Ward Jackson, Vice President of Commercial Solvents Corporation, was elected President of the Armed Forces Chemical Association, New York Chapter, at the organization's annual meeting held recently at the Roosevelt Hotel in New York City.

Mr. Jackson, a chemical engineer, has been associated with the chemical industry in sales and production capacities since 1933. During World War II he served as special assistant to the Vice-Chairman of the War Production Board, and as an aircraft consultant to several WBP bureaus.

Other officers elected at the AFCA meeting included Mr. James Sheridan, Treasurer of Allied Chemical and Dye Company, who was named 1st Vice President; Mr. Richard W. Eddy, Assistant Manager of the Fine Chemicals Division of Carbide and Chemical Company, named 2nd Vice President; and Mr. Joel Henry, Advertising Manager and Assistant to the General Sales Manager of Chemical Construction Corporation, named Secretary-Treasurer.

WILMINGTON:

Charles M. Cooper Heads Division of the A.C.S.

Charles M. Cooper of the E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., a member of the Wilmington Chapter of A.F.C.A., has been elected chairman of the American Chemical Society's Division of Industrial and Engineering Chemistry.

Mr. Cooper, who is director of the engineering research laboratory in Du Pont's engineering department, received a B.S. degree in chemical engineering from the Massachusetts Institute of Technology in 1925, and three years later became director of M. I. T.'s School of Engineering Practice. He joined the Du Pont Company in 1936.

During the war he temporarily left du Pont to serve as director of the engineering division at the University of Chicago's Metallurgical Laboratory.

A.F.C.A. PLAQUE FOR COL. MACLACHLAN

FOR MERITORIOUS SERVICE—Colonel Walter L. Maclachlan, deputy commander of the Army Chemical Center who has presented awards many times, received recently one for outstanding effort performed on behalf of the Edgewood chapter, A.F.C.A. Gerald J. Fleming, then the president of the Edgewood chapter, made the presentation.

THE DIRECTORY NEEDS YOUR HELP

Please submit, by July 31, 1956, all corrections or changes desired in AFCA Directory listings to the

Secretary-Treasurer
Suite 819, Park Lane Building
2025 Eye Street, N. W.
Washington 6, D. C.

THE PUBLIC HEALTH SERVICE CIVIL DEFENSE PROGRAM

By BERNARD B. BERGER* and HARVEY F. LUDWIG**

This article is the second of a series of papers selected by the JOURNAL for publication from presentations at a symposium on respiratory protective devices conducted last year in Cincinnati, Ohio under the auspices of the American Chemical Society. The meeting was sponsored by the Division of Industrial Chemistry of which Dr. E. W. Comings is chairman. Mr. Saul Hormats of the Army Chemical Corps was chairman of the symposium.

Although written a year or more ago, the article is stated to reflect substantially the current interests and activities of the Public Health Service in the field of protection against biological warfare and certain other public health hazards.—Ed.

IN JULY 1954, the Administrator of the Federal Civil Defense Administration, with the approval of the President, delegated certain civil defense responsibilities to the Department of Health, Education, and Welfare. As a result of this delegation, the U.S. Public Health Service has been assigned new tasks in research and training, and would participate in direct operations during a national emergency.

In the light of the unique problems that would confront the United States in an imminent war situation and during war, these tasks clearly have an urgency not heretofore experienced in the defense of this nation. It is not necessary to attempt to describe the probable situations our target populations would face. The potentialities of the so-called "unconventional weapons" have been discussed soberly in publications available to all of us. You will, we are sure, agree that it would be unrealistic to ignore these new dangers. We would like to tell you about the responsibilities placed on the Public Health Service, and of the planning already under way for developing a feasible plan for protecting the public health of the nation.

The Public Health Service has been given the following major tasks:

1. Plan a national program for the protection and emergency restoration of community facilities essential to health. As part of this task, the Public Health Service has been directed to develop the data required to guide the States and communities in planning measures designed to reduce damage to hospitals, water works, sewage collection and disposal systems, and other public health facilities, and in planning protective shelters for personnel associated with these facilities.

2. Plan a national program for the protection of humans against biological warfare, chemical warfare, and other public health hazards, as well as against communicable diseases of special significance during periods of stress and disorganization. The Public Health Service mission in this task is to develop procedures that the States and communities may use in their programs for the detection, identification, and control of disease producing and poisonous agents that might naturally occur or be deliberately used against us.

3. Expand the Public Health Service Commissioned Reserve to provide a reservoir of trained professional personnel who could be swiftly mobilized and deployed in areas damaged by enemy attack. The provision of emergency public health services from support areas is essential to any realistic civil defense program. Unless such services are planned in advance of the emergency, the protection of an attacked population may be hopelessly ineffective. It is, therefore, a matter of the utmost importance that recruitment of professional personnel engaged in fields allied to the health sciences proceed without delay. The Reserve Component of the Public Health Service Commissioned Corps constitutes an effective mechanism for such recruitment as well as for necessary specialized training of personnel. It is quite possible that some of you attending this meeting may be able to render valuable service to this national program. Later in this discussion, we will mention further details of this aspect of the Public Health Service civil defense plan.

The potential target areas of the nation are depending on the Public Health Service for guidance in the solution of health problems that may result from attack by unconventional weapons. Information appropriate to civil defense health protection doctrine and techniques must be given to responsible State Health and Civil Defense authorities by means of a specially organized training program. Programs for conducting research and developing training courses are already under way. In order to define the problems of maximum importance and to avoid unnecessary duplication of research effort, the assistance of the Army Chemical Corps, other units of the Department of Defense, and the Atomic Energy Commission, as well as the Federal Civil Defense Administration, is being utilized in the Public Health Service program. Continuing close liaison with these agencies is being maintained. . . .

Laboratory Research Program

The Public Health Service civil defense research program is directed to the surveillance of our environment for the unnatural presence of pathogenic, toxic, or poisonous substances, and to the development of effective protection against these agents. The following research projects are being conducted:

1. *Mass Immunization Studies.* This research is directed to the development of techniques for raising the level of resistance of our target populations to diseases that might be significant in war emergencies. The improvement of immunization procedures would strengthen our first line of defense against biological warfare attack. In addition, it would provide an essential health protec-

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tion under conditions of disrupted sanitation facilities, and of mass existence under primitive conditions in evacuation camps. An essential element of this research is the development of vaccines of enhanced effectiveness. The reduced amount of antigen thus required would permit a combination of vaccines to be given in a single inoculation. The practical importance of this procedure would, of course, be reflected in the reduced expenditure of medical effort required in providing minimal medical support to the war-important or target population. Multiple vaccines are not new. They are already being used for certain childhood diseases, and for vaccination against a number of different subtypes of influenza virus. Those of you who are associated with the pharmaceutical industries will know that many agencies, in addition to the Public Health Service, are vitally interested in this type of research.

2. *Detection, Prevention and Control of Airborne Diseases.* One of the threats that the United States may face is an enemy attack on our war-important populations with biological warfare materials disseminated either in open warfare or by sabotage. The protection of our people from airborne materials represents a type of challenge rarely encountered in peacetime public health practice. The most feasible approach to protecting our population is based on an elaboration of our present medical diagnostic and reporting procedures, and our present public health control measures.

In order that control measures may be applied sufficiently early to prevent mass casualties, it is essential that our medical and public health personnel be alerted as soon as possible after an attack has occurred. An early warning of such an attack requires the availability of detection procedures. Since airborne particles may not be depended upon to register themselves on our ordinary senses, we must utilize a sensitive air sampling technique for the detection of materials whose presence in the atmosphere represents a completely abnormal situation.

We wish to stress at this point that the detection of abnormal airborne substances is not synonymous with the identification of such materials. The initiation of control measures for protection need not await such identification. Our research is, therefore, directed to the development of self-operating air sampling units with an automatic arrangement for incubation of viable particulate material. Two types of air samplers are being studied. A liquid impinger designed on a sequential sampler arrangement so that separate samples are automatically collected for controlled periods of time on a round-the-clock basis. The other approach is the development of a solid media collection device on a rotating time-controlled base so designed that the variation of microbiological count with time may readily be noted. The liquid impinger device will permit an analysis for the presence of viruses and rickettsia by inoculation of test animals or by tissue culture techniques. Many agencies have done research on such air samplers. The Army Chemical Corps has been particularly helpful to the Public Health Service in this program.

Protection following an airborne attack with biological warfare agents requires the destruction or inactivation of such materials that persist in viable form for prolonged periods of time. Secondary aerosols resulting from biological warfare attack may need to be decontaminated in order that essential activities may be carried on. For this reason research is being conducted on disinfecting agents and on techniques appropriate to the destruction of microorganisms known to be highly resistant to normal environmental conditions. This research program involves the evaluation of the common bactericidal agents and the search for more effective methods for this purpose. The development of techniques requiring a minimum of manpower and producing a minimum of damage to surfaces constitutes an important phase of this work. The extensive research on this problem conducted by the Army Chemical Corps is of considerable aid to the Public Health Service.

3. *Laboratory Techniques for Rapid Identification of Biological Agents.* In order that prophylaxis and therapy may be properly utilized, it is necessary that the agent used by the enemy be rapidly identified. The present procedures for such identification are generally laborious and time-consuming. This is particularly true for viruses and rickettsia which in some cases may require weeks for identification. Recent research has resulted in significant improvement in rapid identification techniques, and our experience indicates that intensified efforts may prove to be very profitable.

The membrane filter technique for the collection and growth of bacterial pathogens is of particular interest. Further research with this device is expected to produce improved techniques for the rapid growth of such microorganisms.

The application of chemical and physical principles to the problem of identification of biological warfare agents promises to shorten the time required for such identification very significantly. The identification of bacteria by means of infrared radiation absorption spectra is under intensive study at the Robert A. Taft Sanitary Engineering Center in cooperation with Fort Detrick of the Army Chemical Corps. There is little doubt that this technique will soon be a powerful tool for the microbiologist.

The study of serological techniques for the rapid identification of biological warfare agents is being actively pursued at the Communicable Disease Center. Many such approaches to the solution of this problem appear feasible. Among these are the use of specific bacteriophage and the use of antisera tagged with fluorescent dyes. Such novel techniques if successful would permit the identification of pathogens in a matter of an hour or less, instead of the days or weeks presently required for this purpose.

4. *Protection of Basic Sanitation Facilities from Biological, Chemical, and Radiological Contaminants.* This research is directed to the protection of drinking water, milk, and food against open or covert contamination by biological, chemical, and radiological warfare agents. An essential element of this research is the study of the vulnerability of these facilities to enemy attack. The procedures that may be developed by the Public Health Service will not, of course, reduce the need for alert policing and rigid security practices by responsible authorities. These measures are basic to any protection program.

The Sanitary Engineering Center is conducting an evaluation of the effectiveness of present methods of water purification for protecting drinking water against contaminating materials introduced into water sources. The ability of chemical coagulation and settling, filtration, and chlorination to destroy or remove biological, chemical, and radiological warfare agents in water is under intensive study. It is proposed that new procedures and equipment be devised where necessary to strengthen current practices found to be inadequate. A special study is being made to determine methods of protecting water distribution systems against covert enemy attack. Considerable emphasis is placed on the need to develop reliable procedures for the early detection and identification of contaminants and for their effective control.

A similar evaluation of the vulnerability of milk and food supplies to covert attack is under way. Research is being conducted at the Sanitary Engineering Center to

develop, or improve, protective measures that may be applied in a practicable way to milk suppliers and to food in retail channels or in consumer hands.

Other Studies and Investigations

Several important phases of the Public Health Service civil defense program do not involve laboratory research. One such project is based on the anticipated needs of an evacuated population under severe stress. It is quite clear that a realistic civil defense program must foresee the need to offer protection to panicked and disorganized populations. The Public Health Service is, therefore, developing procedures for handling the essential problems of sanitation involved in the mass dispersal of populations from target areas, and is developing a plan for maintaining sanitary conditions in emergency hospitals, shelters, and evacuation areas.

Another Public Health Service program which should be mentioned is a study of the effects of atomic blasts on works and structures essential to health, such as water supplies and hospitals. The object here is to translate the multitude of information available from the continuing atomic weapons test programs to practicable design criteria ready for use by architects, engineers, and others concerned with design of such works and structures.

The Public Health Service is developing civil defense training courses which will be based in large measure on the results of our research and special investigations. Major emphasis is currently being placed on providing the basic material required for training health officers, sanitary engineers, epidemiologists, laboratory workers, and other key personnel concerned with civil defense in the States and cities. I am sure you will appreciate the difficulty our training specialists are experiencing in the development of training courses that may be helpful to such individuals. These men bear the heavy responsibility of protecting the health of their communities against the new types of warfare, and they are depending on the Public Health Service to provide basic information on how to do it. It is perhaps not hard to describe the health problems our target populations may face in the event of attack with nuclear weapons, or biological, chemical, and radiological warfare agents. It is quite another thing to provide useful, practicable solutions to these problems. Each major Public Health Service research element is participating in this civil defense program. These include the National Institutes of Health, the Communicable Disease Center, the Rocky Mountain Laboratory, and the Robert A. Taft Sanitary Engineering Center. It is believed that the degree of protection offered our target populations against the new weapons available to potential enemies will depend on the successful outcome of this research. In this connection it may well be that an enemy would be reluctant to use the biological, chemical, or radiological warfare weapon against us if they knew we were able to defend ourselves effectively. If war comes, the contribution of the Public Health Service will be an essential factor in determining the extent to which our population may survive and fight on in wake of an enemy attack.

Reserve Health Personnel

It is foreseen that during and in the aftermath of an enemy attack on our country, the need for professional health personnel would be overwhelming and would far exceed those professional personnel now employed by the official health agencies. Recognizing this, the Administrator of the Federal Civil Defense Administration has requested the Public Health Service to augment and strengthen the health resources of the nation through selective recruitment and training of a reserve of competent personnel.

It is not intended, nor is it possible, to depend on our present supply of health workers for the implementation of this program. In many essential categories of health work there are just not enough trained personnel to do even the peacetime job, let alone the immensely important but difficult tasks that may be expected to arise with suddenness and impact in an emergency. The Public Health Service must look to the professions allied to the health sciences for the required support. Certain members of the American Chemical Society may be in a position to render very valuable service to the nation by participating in this Public Health Service program. Those employed in the food and pharmaceutical industry and in the waterworks, sewage treatment and food processing equipment industries can help. Chemists associated with university sanitary engineering departments, and other agencies dealing with water, milk, food, and air quality, and with radioactive materials will be able to do very useful work in emergencies.

The mechanism to be used in the recruitment, training, organization, and use of our emergency pool of health workers is the Reserve component of the Public Health Service Commissioned Corps. An applicant for an inactive commission in the Reserve will be selected on the basis of his potential contribution to this emergency health program. Personnel will be commissioned in the category appropriate to their profession. The Public Health Service Commissioned Corps categories include Medical, Dental, Nurse, Sanitary Engineer, Sanitarian, and Scientist Officers. The grades of commissioned officers on active duty are based on academic training and professional experience, and are comparable with those of the Army, Navy, and Air Force in compensation. Estimates of needs in each of the various professional categories are being based on studies now under way to evaluate, on a regional basis, the logistics involved in the various anticipated health emergency situations.

The Public Health Service plans to organize Reserve Officers as teams composed of medical, nursing, sanitary engineering, and scientific personnel. Training will be directed to the individual as well as to the team as a unit. Training will be essentially "at home" training to reduce to a minimum interference in the officer's normal living and work habits. Special informational materials will be forwarded to Reserve personnel and teams. Close technical and administrative guidance will be provided by officers on regular employment duty. As the civil defense program progresses, Reserve officers may wish to volunteer for active duty for short periods for purposes of intensive orientation and training at one of the Public Health Service training stations. Also, Reserve officers will have opportunities to participate on active duty, on a voluntary basis, in regular Public Health Service program activities of interest to them, both in the United States and abroad, for periods of time from a few weeks to a year or more.

The Public Health Service Reserve played a major role in solving the critical health problems of the nation during World War II, and its preparation for the emergencies of the future is a vitally important program of the Public Health Service. The Commissioned Reserve is the key to effective mobilization of the nation's critical health resources. The Commissioned Reserve is an emergency reserve, and an officer would be called to active duty without his consent only in event of a national emergency publicly recognized as requiring such action—when the survival of large segments of the nation's population is at stake. This is the situation for which we prepare.

Individuals who are interested in serving in the Public Health Service Commissioned Reserve should communicate with the Surgeon General, U.S. Public Health Service, Department of Health, Education, and Welfare, Washington 25, D.C.

CHEMICAL CORPS NEWS

COL. J. H. ROTHSCHILD IS PROMOTED TO BRIG. GEN.

Colonel Jacquard H. Rothschild has been promoted to temporary brigadier general. Senate confirmation of the appointment was announced late in May and promotion ceremonies were held in the office of Major General William M. Creasy, Chief Chemical Officer, Department of the Army.

General Rothschild's position assignment is Commanding General, Research & Development Command. This is one of the new commands established pursuant to recommendations of the Miller Committee which recently studied the Corps' organization. Just previous to this assignment General Rothschild had served for two years as president of the Chemical Corps Board.

General Rothschild is a graduate of the United States Military Academy, Class of 1930. He has a Master of Science degree in Chemical Engineering received in 1940 from the Massachusetts Institute of Technology. In World War II he commanded the 93rd Chemical Mortar Battalion in France and Germany. Prior to that assignment he commanded the Chemical Warfare Service Development Laboratory at Massachusetts Institute of Technology. After the War he served as Assistant Professor of Chemistry at West Point and later as Chief Chemical Officer in the Far East.

THEODORE MARSHALL MADE BRIG. GEN. IN THE RESERVE

Mr. Theodore H. Marshall, of Leaderle Laboratories, New York, a division of the American Cynamid Co., is now a brigadier general in the Army Chemical Corps Reserve, his nomination to that grade having been approved by the Senate on May 18.

General Marshall served in the Chemical Warfare Service during World War II, his last position being Executive Officer and deputy to the Commanding General, Chemical Warfare Service Technical command. He was responsible for much of the work in design and construction of manufacturing plants, and was awarded the Legion of Merit.

MARINES LAND AT DUGWAY!

Dugway Proving Ground, test station of the Army Chemical Corps in the Utah Desert, has announced the recent arrival there by air transport of the Third 4.5 Rocket Battery of the Marine Corps for maneuvers and field tests with the Second Chemical Weapons Battalion stationed at Dugway. The home station of the Marine battery, which is commanded by Captain Leon Mordecai, is Camp Pendleton, California.

Members of the Third 4.5 Rocket Battery of the Marine Base at Camp Pendleton, Calif., assembling after their arrival at the Dugway airfield.

The announcement points to considerable saving of government funds resulting from this cooperative training program. All operations including those of the Marine battery will be directed by Major Louis J. Stefani, commander of the Chemical Weapons battalion.

CML CORPS DECONTAMINATES POLIO EXPOSED AIRPLANE

DECONTAMINATION PROCEDURE . . . An Army Chemical Corps team from Ft. Detrick, Md., is shown above in the process of decontaminating an airplane at the Washington National Airport. The airplane was exposed to live polio virus when part of the virus shipment was damaged. Team members were—G. Briggs Phillips, Everett Hanel, Jr., Bernie Surkiewicz, and Isaac J. Fish.

A.C.C. SPECIALISTS' SCHOLARSHIP

Members of the Army Chemical Center (Maryland) Enlisted Specialists' Club sponsored a scholarship again this year for a June graduate of a Harford County, Maryland, High School. The collection goal set for the Scholarship Fund was $750.00. Qualifications for the award are demonstrated ability, a desire to learn and a need for financial assistance.

In 1953 winner of the Club scholarship was Jack Jones of Whiteford, now attending Maryland State Teachers College in Towson, Maryland. He is President of the Junior Class.

The 1954 winner, Louise Reed of Fallston, is studying for a degree in medical technology at Elizabethtown College in Pennsylvania.

Last year's winner, Richard Reitz of Belair, is enrolled at the University of Maryland.

AWARDS TO BACTERIOLOGISTS

Two government bacteriologists—one a Fort Detrick employee—were honored for outstanding work at the annual Fort Detrick meeting of the Maryland Branch of the Society of American Bacteriologists on April 12.

Detrick scientist Martin R. Ross, part-time student as candidate for a doctor of philosophy degree at George Washington University, received the J. Howard Brown award in recognition for his research work with respect to psittacosis and lymphogranuloma group of viruses. The other honor, the Barnett Cohen award, was extended to Dr. Leon M. Jacobs, Senior Scientist at the National Institutes of Health, Bethesda, in recognition of his work in respect to the disease known as toxoplasmosis.

The presentations were made by Dr. Donald Shay of the University of Maryland.

DR. JANDORF HEADS DIVISION

Dr. Bernard J. Jandorf has been appointed Chief, Biochemical Research Division in the Directorate of Research, Chemical Warfare Laboratories, at the Army Chemical Center, Maryland. He will continue to hold his post of Chief of the Enzyme Chemistry Branch, a part of this Division.

CML CORPS AND RCA DEVELOP AUTOMATIC NERVE GAS ALARM

The automatic field alarm, shown on front cover being carried by a soldier, was developed by the Army Chemical Corps and the Radio Corporation of America Laboratories at Camden, New Jersey, to act as an unattended detector and alarm for the chemical warfare agents known as "nerve" or "G" agents.

Nerve gases are colorless and odorless and cannot ordinarily be detected by the human senses before the amount in the air reaches the danger point. Development of a reliable detector which would give warning at the first signs of the presence of the gas has been the subject of continuing research by Chemical Corps scientists over a period of about three years.

The detector weighs about 25 pounds and is contained in a metal carrying case about 15 inches high, 17 inches long, and 8 inches wide. When connected to a 110-volt AC or 24-volt DC power source, it will operate continuously for 12 hours. After this period it can be serviced in a matter of minutes and again put into operation.

Upon detection of very small traces of nerve gases, the detector lights a self-contained red warning lamp and sounds a loud buzzer. It can also set off an alarm at other points, such as a remote warning panel.

Chemical Corps authorities state that the alarm is capable of effective operation even under heavy dust or smoke conditions, since it contains a special filtering feature for this purpose. It is anticipated that the detector can be adapted to requirements of civil defense.